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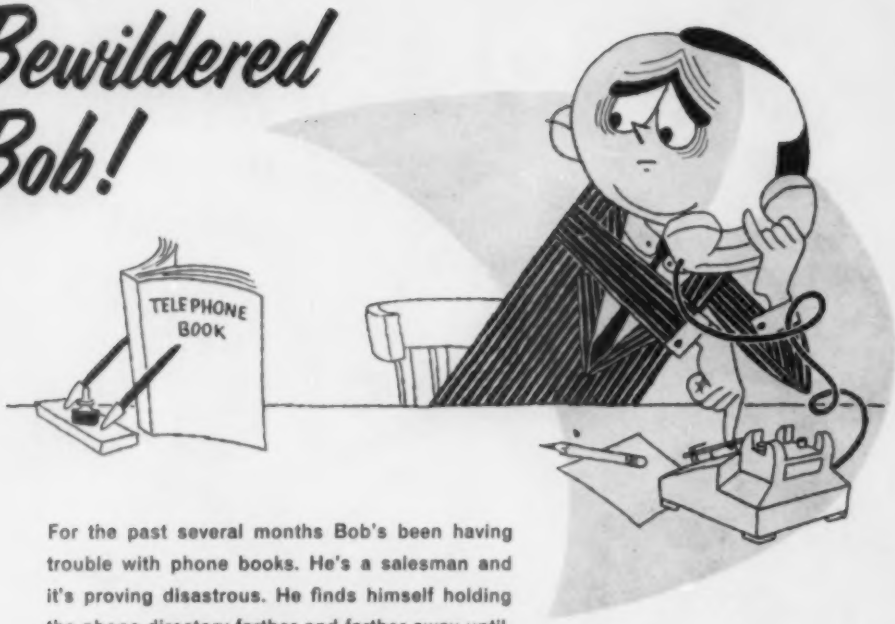


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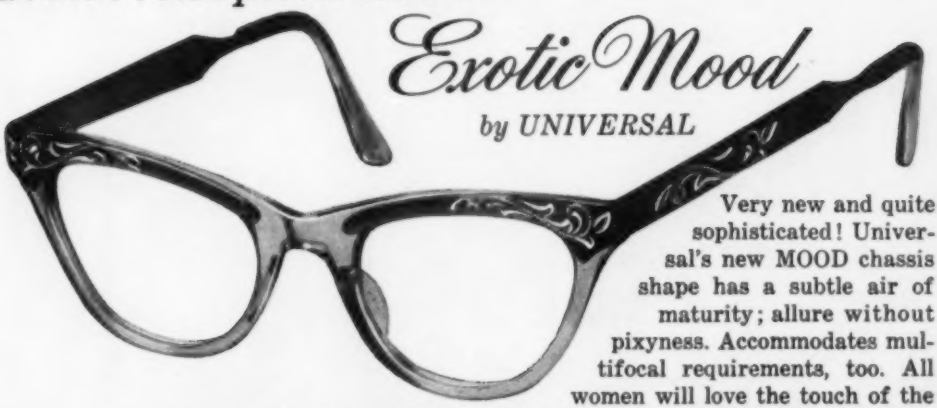

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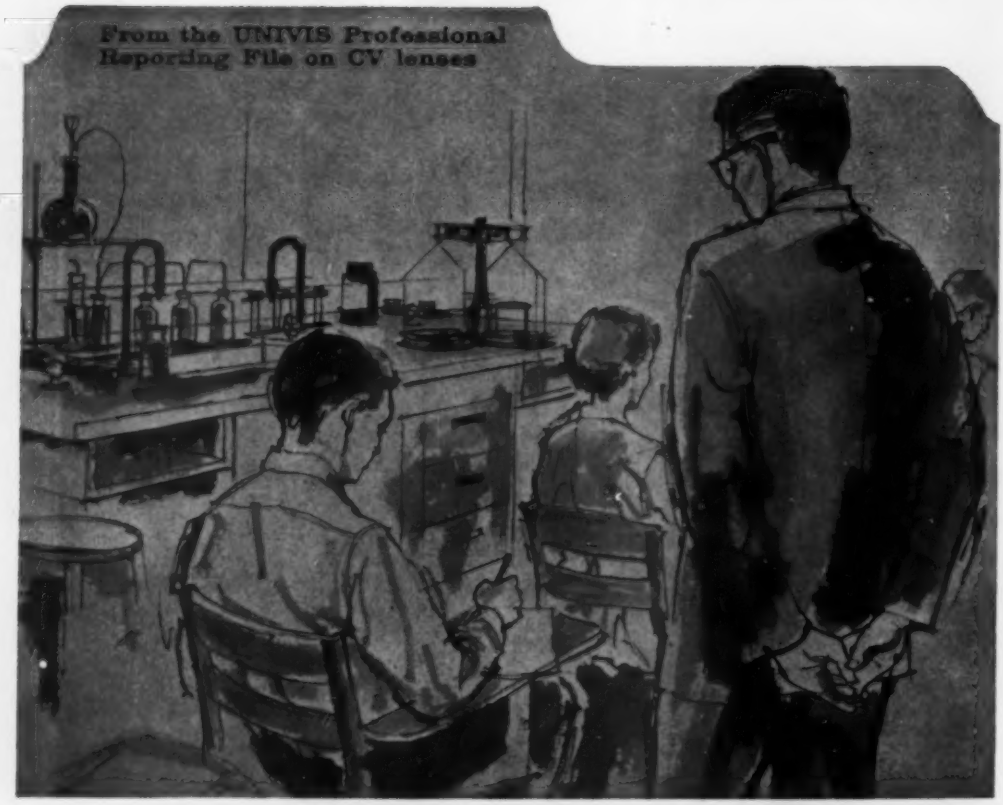


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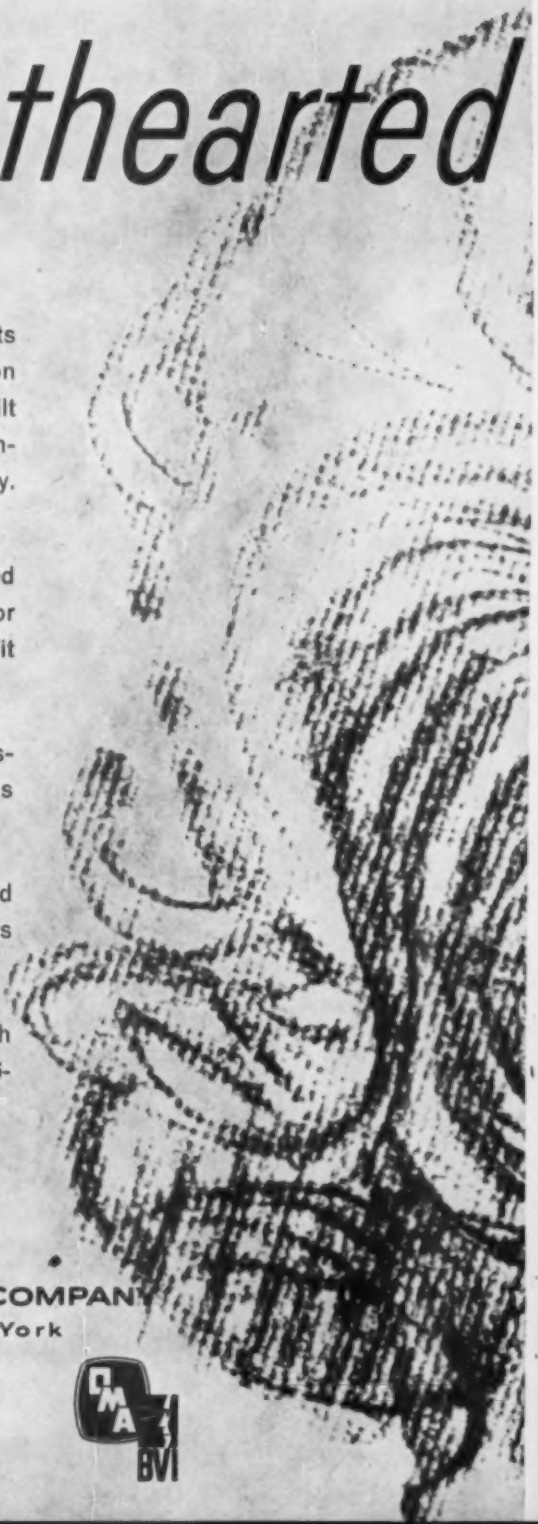

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[See page 50]

AMERICAN JOURNAL OF OPTOMETRY
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# INCIDENCE OF ULTRAVIOLET RADIATION AND TRANSMISSION BY THE EYE*

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Within recent years, there has been renewed interest in the effect of near ultraviolet radiation on vision. Attempts have been made to show that exposure to ultraviolet radiation increases the absolute threshold of vision, alters the critical flicker frequency and affects the dark adaptation of the rods and cones.[1] From these studies a number of basic facts emerged: in general, they indicate that although vision is affected detrimentally by exposure to ultraviolet radiation, the resulting impairment generally is not significant. Even in the laboratory, precise conditions need be met for its demonstration.

The effects of ultraviolet radiation on the cornea also have been studied at some length because of the common burns resulting from welders arc, quartz mercury vapor lamps and keratitis from exposure to solar radiation at high altitudes or in the presence of large snow fields.[2] The wave band responsible for the keratitis forms a sharp peak at 288 mμ falling off to approximately zero at 305 mμ on the long end and reaching a minimum at 260 mμ on the short end.[3] These effects are attributed to the absorption of the ultraviolet radiation by the epithelium of the cornea.

Interest in the investigations described above in some measure detracted from other possible effects of near ultraviolet radiation on the eye. For many years, it has been known that ultraviolet rays below 310 mμ are absorbed by the cornea and rays below 400 mμ are absorbed by the lens. Also, the absorption of the lens increases with age. That this absorption might have a deleterious effect on the lens has been known. However, a full appreciation of this possibility has been hampered by numerous problems. One of these problems is the exposure by a person to ultraviolet radiation under ordinary circumstances. How much radiation from the sun is reflected by the sky under various conditions? How much radiation is reflected from snow, concrete highways, sand,

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mineral deposits, etc.? Another problem concerns the effect of large sources of ultraviolet radiation, such as a blue sky, on the lens. From a small source, incident radiation on the lens is spread over the area of the lens exposed by the pupil. From a large, extended source, the radiation is concentrated in the lens. What is the possible accumulative effect of such action over a protracted period of time? Another problem, large and to some extent still unsolved, is the exact mechanism of production of a cataract. Many theories have been propounded. If ultraviolet radiation contributes to the formation of cataracts, what is the probable mechanism?

In general, cataracts are an anomaly of the aged. Also, the lens absorbs practically all of the near ultraviolet radiation and this absorption increases with age. If a person normally is exposed to extended sources of ultraviolet radiation of relatively high intensity and if the lens effectively concentrates this radiation, an investigation of its possible role in the development of cataracts is warranted.

ULTRAVIOLET SPECTRUM

Ultraviolet radiation usually is defined as electromagnetic radiation of wave length from 4 to 400 m$\mu$. The portion near the visible spectrum is called the near ultraviolet: its range extends from 300 to 400 m$\mu$. Below the near ultraviolet is the far ultraviolet: it extends to 200 m$\mu$. The range from 200 to 4 m$\mu$ is called the extreme ultraviolet.

Figure 1 illustrates the relative positions of the various ranges in the electromagnetic spectrum. It is seen that the visible range extends from 400 to 780 m$\mu$. These limits are not rigidly defined as they vary from one person to another. For example, young people with normal sight can see as far into the ultraviolet as 313 m$\mu$. However, with advancing years, the ability to see even beyond 400 m$\mu$ is lost.[4, 5, 6]

The response to ultraviolet for the normal eye falls off very rapidly with wavelength (Figure 2). In one investigation the sensitivity at 365 m$\mu$ was found to be only 1.5 per cent of that of 405 m$\mu$ and the sensitivity to 313 m$\mu$ was 0.5 per cent that of 405 m$\mu$.[7]

The principal color filter of the human eye is the lens, and this of course affects its spectral sensitivity. With the loss of the lens the eye

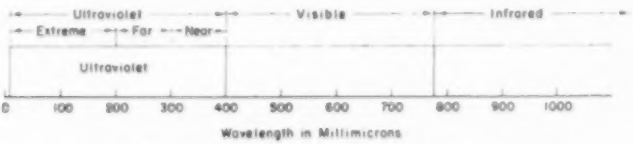


Fig. 1. The electromagnetic spectrum.

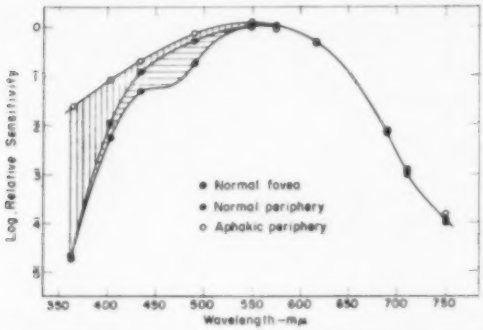


Fig. 2. Spectral sensitivity of cone vision in the normal fovea, and in an area 8° above the fovea in the normal and aphakic eye. The vertically hatched area represents the optical density of the lens (Wald).

gains enormously in sensitivity in the far violet and near ultraviolet. This is shown in Figure 2 by the vertically hatched area; on the average, aphakic subjects are about 1,000 times as sensitive as normal persons at 365 mu.[5]

This paper concerns only one aspect of the problem, namely, the incidence of solar ultraviolet radiation and the transmission of this radiation by the eye. Other papers will consider different aspects of the problem such as the effect of ultraviolet radiation on the lens, the enzyme profile of the normal and cataractous lens and the role of ultraviolet radiation on enzymatic activity.* Collectively, it is hoped that all of the reports will establish a firm basis for the preventative care of the eyes from this radiation.

TRANSMISSION OF THE LENS

The transmission of the aqueous and cornea on the one hand and the lens on the other is illustrated in Figure 3. A rabbit eye was used for the data of the cornea and aqueous and an 8 year old Macacus rhesus monkey for the lens. The large open circles plotted with the lens data are visual measurements of the transmission of the human lens in observers of average age 21.

It is generally agreed that the increased loss of sensitivity of the eye to ultraviolet with age is due to an increase in absorption by the lens. This change is concurrent with an increase in fluorescence of the lens.

ABIOTIC EFFECT

The relative erythemal effectiveness of ultraviolet is illustrated in

*Cf. Wild, B.: The Effect of Ultraviolet Light on the Eye, in this issue of this publication. Also, Frajola, W.: Enzyme Patterns of the Lens: submitted for publication in the Am. J. Ophth.

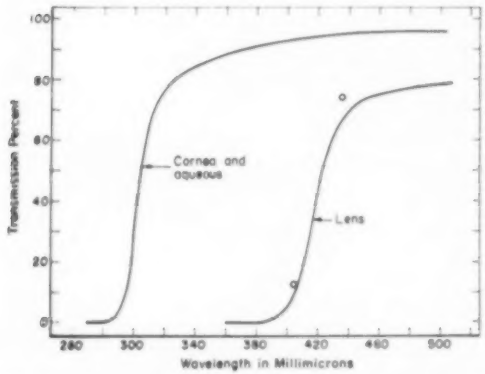


Fig. 3. Comparison of the transmission of the aqueous and cornea with the lens. The open circles are visual measurements on human subjects age 21 (Wald).

Figure 4. Since the cornea absorbs all rays below 310 mu. it is seen that practically none of the erythemal rays reach the lens.

The erythemal rays will not be discussed in this report. However, it is interesting to note that for the adult eye the near ultraviolet extends from the upper limit of the rays producing erythema to the lower limit of the visible rays. For the most part, the rays in this region do not have an abiotic effect, are not visible, produce little or no harmful effect on vision, and almost are completely absorbed by the lens. Does this absorption impair the lens? Before considering an answer to this question, it is necessary to investigate the incidence of ultraviolet radiation.

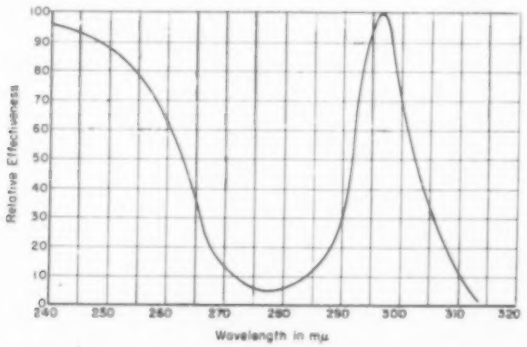


Fig. 4. The erythemal curve showing the relative effectiveness of equal amounts of energy in different parts of the spectrum in producing erythma.

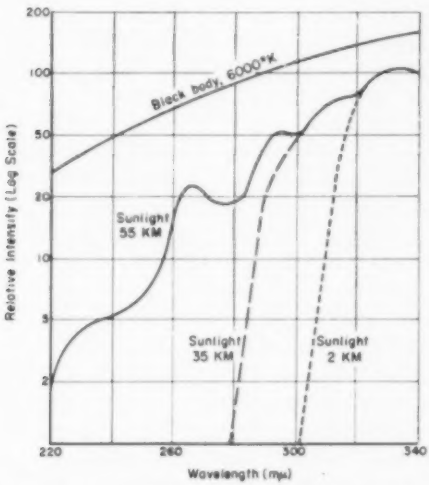


Fig. 5. Ultraviolet solar spectral energy curves for different heights above the earth's surface (Hulburt).

Of particular interest, will be frequency as well as intensity of the radiation exposed to the eyes.

INCIDENCE OF ULTRAVIOLET RADIATION

The sources of ultraviolet radiation can be classified as natural or artificial. The only natural source is the sun. Of course, there are many artificial sources but usually these are not frequently encountered or indiscriminately used.

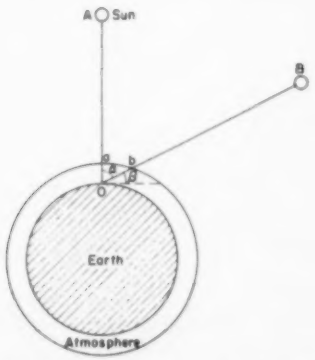


Fig. 6. Relation between air mass and solar elevation.

The sun is an incandescent mass having a surface temperature of 6000° K. If the solar energy distribution outside of the earth's atmosphere is compared to that of a black body at the same temperature, the data illustrated in Figure 5 are obtained.[8] It is seen that the black body curve is a smooth one: the solar radiation has super-imposed on it an absorption spectrum of the gases in the solar atmosphere. When a correction is made for the absorption of ultraviolet by the atmosphere, it is fairly closely represented by a black body at 4000° K.

The solar ultraviolet intensity at the earth's surface depends on a number of factors including time of day, time of year, latitude, elevation above sea level, atmospheric turbidity, and thickness of the ozone layer. A common denominator for the first four factors is the air mass.

AIR MASS

The thickness of the air mass for solar radiation reaching the earth varies with the elevation of the sun. When the sun is directly overhead, the thickness is minimal; when it is near the horizon it is relatively large. These effects are illustrated in Figure 6. In this figure, angle $\beta$ is called the solar elevation and angle $\alpha$ the solar zenith distance. Their sum is 90°.

The distance through the atmosphere traversed by radiation is defined as the air mass: it is unity when the sun is in the zenith. For other elevations, the air mass is given in Table 1. The variation of the air mass for any point in the earth's surface depends not only upon the time of the day but also the season of the year, and the latitude. For one latitude, i.e., 30° north, the expected altitude of the sun throughout the year is provided in Figure 7. Using this data together with Table 1, one can determine the air mass at any given time. Similar data for other latitudes are available in the literature.[9]

TABLE I

| Solar Altitude | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Air mass | 10.40 | 5.60 | 2.90 | 2.00 | 1.55 | 1.30 | 1.15 | 1.06 | 1.02 | 1.00 |

ATMOSPHERIC ABSORPTION

As radiation passes through the atmosphere it is absorbed. If $I_o$ represents the original intensity, the intensity after passing through a unit air mass will be $aI_o$. After traversing an air mass of m units, the intensity, I, will be

$$I = I_o a^m$$

where a = the transmission coefficient for an air mass of one, and m = the air mass.

The transmission coefficient varies with the wavelength. This effect is shown in Figure 8 for various values of the air mass. It is inter-

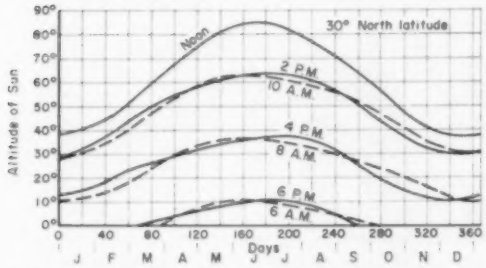


Fig. 7. Solar altitude as a function of day of year and time of day (Benford).

esting to note the marked increase of transmission for the near ultraviolet with a decrease in the air mass.

The atmosphere about the earth serves as a very effective filter for wavelengths shorter than 290 mμ. Although much of this effect is due to absorption, i.e., conversion to heat or other forms of energy, not all of it can be explained on this basis. Now, it is believed that a blanket of ozone in the upper atmosphere selectively absorbs the shorter wavelengths and accounts for the difference.

ATMOSPHERIC SCATTERING

Solar radiation traversing the atmosphere not only is absorbed but also it is scattered. This effect is produced by very small particles in the atmosphere such as dust, water droplets, and gas molecules. Providing that the size of the particles are smaller in diameter than a wavelength, the intensity of the scattered light, I is given by:

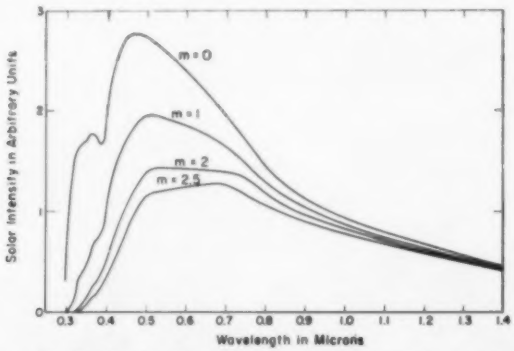


Fig. 8. Energy distribution in the solar spectrum as observed on the earth's surface for various values of the air mass.

$$I = \frac{I_o}{\lambda^4}$$

where $\lambda$ = the wavelength, and
$I_o$ = the intensity of the unscattered light.

This is known as the Rayleigh scattering.

Since red light, $\lambda = 720$, has a wave length 1.8 times as great as violet light, $\lambda = 400$, the law predicts $(1.8)^4$ or 10 times greater scattering for the violet light.[10] Obviously, the scattering even is greater for ultraviolet rays.

It is the scattering of the short wavelengths that produce the blue color of the sky. Without scattering, the sky would be black and only radiation passing directly from the sun would be seen.

If white light is scattered by particles larger in diameter than the incident wavelength, the light is white, due to ordinary diffuse reflections from the surface of the particles. Chalk dust is a good example of such scattering.

The quantitative expression for the attenuation of radiation in passing through an absorbing or scattering medium is

$$I_t = I_o e^{-at}$$

where $I_o$ = the initial intensity,
$I_t$ = the intensity after traversing a thickness t, and
$a$ = the attenuation coefficient.

If the attenuation process is considered partly scattering and partly absorption, the attenuation coefficient may be stated as

$$a = a_s + a_a$$

where $a_s$ and $a_a$ are, respectively, the scattering and absorption coefficients so the expression becomes

$$I_t = I_o e^{-(a_s + a_a)t}$$

For wavelengths above 300 $m\mu$ the attenuation from the atmosphere on a clear day is due mostly to Rayleigh scattering.[7, 10]

SKY RADIATION

As a result of repeated scattering of solar radiation in the atmosphere, a very significant amount of ultraviolet reaches the earth's surface from the sky as well as directly from the sun. On a clear day at some hours the amount of ultraviolet falling on a horizontal surface from the sun and from the sky may be greater than the amount directly from the sun, and at all hours it is comparable in amount with that from the sun.[7] This is illustrated in Figure 9 which shows the radiation received on a horizontal surface from the sun and from the sky at various hours throughout the day. Since the elevation of the sun changes with the time of day, similar curves could be plotted with this parameter.

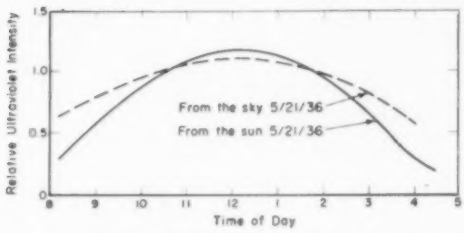


Fig. 9. Intensity of ultraviolet radiation on a horizontal surface from the sun and from the sky at various hours throughout the day (Luckiesch from Koller).

Figure 10 shows the ratio of sky component to direct solar radiation as a function of solar altitude. This ratio applies only to horizontal surfaces. With a decrease in altitude of the sun, there correspondingly is an increase in air mass. As a result, more direct solar radiation is scattered: this accounts for the data in the figure.

Although more ultraviolet is scattered with low elevations of the sun, the increased air mass more effectively absorbs radiation of short wavelength. As a consequence, the total intensity of ultraviolet from both the sky and directly from the sun shows a daily variation. The intensity is greatest with the sun at zenith and decreases with a reduction in elevation of the sun. For relatively short ultraviolet, 310 m$\mu$, the intensity doubled between 9 and 12 A. M. while the total solar energy increased only 7 per cent: the measurements were made on a clear day in Washington, D. C.

SOLAR ENERGY DISTRIBUTION

As pointed out previously, the solar energy distribution at any given point on the earth depends on a number of factors. However, it is feasible to study a typical distribution curve at noontime, on a clear

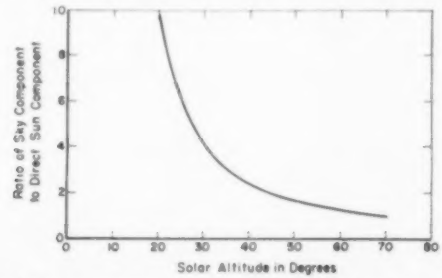


Fig. 10. Ratio of sky component to direct solar radiation as a function of solar altitude (Luckiesch from Koller.)

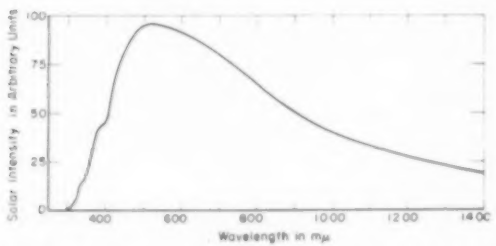


Fig. 11. Solar energy distribution for midsummer noonday sun in Washington, D. C., (Forsythe from Koller.)

day. Such a curve is provided in Figure 11, for Washington, D. C. It is seen that the intensity of ultraviolet increases very rapidly with an increase in wavelength up to 500 mμ. After this point, the intensity gradually decreases. There is no energy of wavelength shorter than 295 mμ.

Measurements by Coblentz show that the solar radiation between 295 and 450 mμ accounts for 10 per cent of the total incident radiation for air mass 1 at Washington, D. C.: the radiation from 295 to 310 mμ is only 0.04 per cent.

The greater scattering of the shorter wavelengths is well illustrated in Table 2. The data in this table show that the intensity of sky light

TABLE 2

Intensity of energy in microwatts per square centimeter on a horizontal surface during midday with clear atmosphere in midsummer in Cleveland, Ohio. (Luckiesch.)[11]

| Wavelength (mμ) | Sunlight | Skylight | Total |
|---|---|---|---|
| 300 | 2.6 | 2.6 | 5.2 |
| 350 | 144. | 115. | 259. |
| 400 | 268. | 165. | 433. |
| 450 | 453. | 216. | 669. |
| 500 | 525. | 193. | 718. |
| 550 | 535. | 154. | 689. |
| 600 | 503. | 118. | 621. |
| 650 | 459. | 97. | 556. |
| 700 | 464. | 85. | 549. |

is approximately equal to direct sunlight for short wavelengths. As the wavelengths increase, the proportion of sky light to the direct sunlight decreases until at 700 mμ it is only about 20 per cent.

EFFECT OF HAZE, SMOKE AND FOG

In addition to latitude, air mass, seasonal variation and time of day, solar radiation also is affected by local conditions such as cloudiness, haze, smoke, dust, fog and humidity. All of these reduce the ultraviolet intensity in varying degrees. Light clouds, and fog decrease the direct solar radiation but increase the scattered radiation. The net result, how-

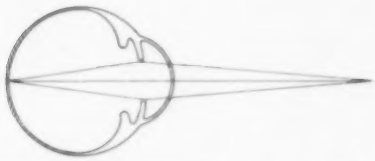

Fig. 12. Concentration of radiation in the eye from a point source.

ever, is a decrease in the total amount of radiation. For heavy clouds the decrease is much greater than for light clouds. The absorption of ultraviolet by the water vapor in the atmosphere is small compared with the absorption of the infrared. Although fog decreases the total ultraviolet intensity, it has very little selective effect on the ultraviolet transmitted.[7]

The atmospheric pollution by smoke and dust in large cities reduces the ultraviolet intensity at times to negligible proportions. Unlike fog and clouds these large particles of opaque material reduce the intensity of all wavelengths equally.

The total amount of ultraviolet, of course, depends upon the relative number of clear and cloudy hours per day and days per year. The records show wide variation in different localities.

CONCENTRATION IN THE EYE

The concentration of radiation in the eye principally depends on the size of the pupil and extent of the source. If the source is very small so that effectively it is a point source, the radiation transmitted by the eye is uniformly spread over the area of the pupil. After passage through the lens, the radiation again is concentrated to form an image on the retina (Figure 12).

From an extended source, as illustrated in Figure 13, the radiation

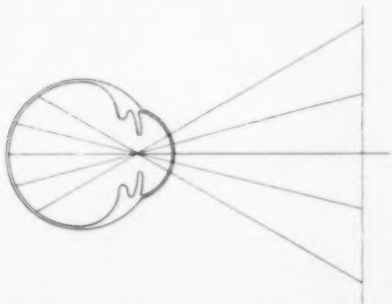

Fig. 13. Concentration of radiation in the eye from an extended source.

from any given point is concentrated as described above. However, since the extended source is composed of an infinite number of such points, the concentration now occurs chiefly in the lens. In fact, "with a large source subtending a maximum solid angle of 120°, while the energy density at the retina is approximately the same as for a small source, that in the region of the pupil is greater by the order of several million times. This effect occurs when the retinal image is of the same brightness, and the spectral character of the illuminant and intensity of the illumination are the same. Thus, while a small area and of relatively small intensity may be harmless to the retina, a similar large area, such as the sky, a snow field, the desert, or a sheet of molten metal or glass, entails an enormous and potentially dangerous concentration of energy in the region of the anterior part of the eye, and particularly in the posterior part of the lens."[12]

The possible deleterious effect of solar ultraviolet radiation now should be evident. Of special importance is the high intensity of ultraviolet radiation from the sky, the frequency and duration of exposure to the sky, and the concentration of radiation in the eye, and especially the lens from any extended source.

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# THE EFFECT OF ULTRAVIOLET LIGHT ON THE EYE*

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## A. PHYSICAL DESCRIPTION OF ULTRAVIOLET LIGHT

Ultraviolet light does not have absolute limits in terms of wave length. Usually any light of wave length that is shorter than the short end of the visible spectrum, i.e., just invisible, is considered to be the upper limit of the ultraviolet band. Generally speaking the biological limits of ultraviolet light are from 400 mμ to 180 mμ, even though the lower limits of ultraviolet may be thought to extend to 10 mμ, the upper limit of the X-ray band, from the physical point of view. The reason for making this distinction is that the atmosphere cuts out almost all of the wave lengths below 300 mμ that are emitted from the sun, so that our only sources of short wave length energy are artificial, such as low pressure mercury discharges. These sources produce energy down to about 180 mμ in wave length, but in insignificant amounts below this value.

In order to aid the discussion, a further classification of the ultraviolet band is often made. This breakdown is based upon the biological effects produced by each of the defined wave length bands.

| *Band* | *Wave length* | *Major sources* |
|---|---|---|
| Ultraviolet "A" | 400 to 315 mμ | sunlight and artificial light |
| Ultraviolet "B" | 280 to 315 mμ | mercury sources and a little from sunlight |
| Ultraviolet "C" | 180 to 280 mμ | low pressure mercury sources |

## B. THE EFFECT ON HEALTH

Any biological effect is due to two major variables, the wave length of the incident radiation and the energy of this radiation. From the viewpoint of general health ultraviolet has some well established functions.

1. The erythemal action.

This is better known as sunburn. The sources of this action are ultraviolet B and C. Apparently normal individuals may have thresholds for sunburn that are quite different (250 to 700 mμ/cm² of λ = 297 mμ), while extremely sensitive people have thresholds that are 100

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times lower. The product of time and energy necessary to produce threshold is approximately valid provided that the time interval is not extended over more than twenty-four hours. Beyond this point adaptive processes occur in the skin that raise the threshold and confuse this relationship. It is also possible, based on this intensity-time product, to obtain a cumulative effect from a number of subthreshold exposures. This fact may have very far reaching implications for the general well-being of the organism.

2. The sun tanning action.

This effect generally occurs concurrently with the erythemal action because most sources provide adequate amounts of ultraviolet A, B and C. However, by selectively filtering out the B and C, thereby allowing only ultraviolet A to reach the skin, it is possible to prove that this band is solely responsible for suntanning. More precisely, the wave lengths between 320 and 369 $m\mu$ have been found to be the most effective for this action. The threshold is approximately 500 to 1,000 times higher than the erythemal threshold in terms of energy.

3. The anti-rachitic effect.

This effect is the only experimental evidence of radiation that is important to health. Ultraviolet B and C forms vitamin D in the skin. Vitamin D is carried throughout the body by the blood to take part in calcium metabolism. The amount of ultraviolet necessary to produce the minimum daily requirements is about 1/10 of the erythemal threshold.

4. The anti-bacterial effect.

This is an indirect effect on health. Certain bacteria are killed by exposure to ultraviolet sources that are rich in the C band, especially around 265 $m\mu$, and to some extent by the B band.[1]

It should be noted that any form of ultraviolet light that falls on a human produces no sensation. Any sensation that is caused by ultraviolet is a secondary effect and is characterized by a latent period that averages seven to eight hours. Certain severe exposures may, however, shorten this latency.[2]

C. THE EFFECT ON THE EYE.

Although much is known about the effect of ultraviolet light on the eye certain evidence is, as yet, inconclusive and even sometimes conflicting. Wherever such doubt is found both sides of the controversy will be presented.

The effect on the cornea.

This effect is so well known that a specific term has been applied to it. The word "photophthalmia" is defined as the acute inflammatory

reaction of the superficial parts of the eye to short waved light.[2] The most effective wave length was found by Cogan and Kinsey[3] to be 288 mμ while other wave lengths are considerably less effective. The absorption peak is close to, but not identical with the absorptive peaks of globulin and albumin (280 mμ). Threshold values for photophthalmia will be attained in approximately one-half hour by looking toward the zenith on a bright sunshiny day.[1] Since few people ever do this, exposure times may be increased markedly, depending upon the reflection coefficients of the objects of regard.

The first indication of damage is a granular appearance of the cornea when seen by slit lamp. This is thought to be due to swollen epithelial cells. Eventually vesicles form, the conjunctiva becomes hyperaemic and swollen and a mucopurulent discharge occurs. It may result in an exfoliation of the epithelium with central opacity and generalized haziness. These changes reach a peak in forty-eight hours or less and usually the cornea is quite normal within three to five days except where permanent damage is done.

Subjectively the person feels nothing for several hours after exposure, then gradually becomes aware of a foreign body sensation. He may also see haloes and become very photophobic. Occasionally the phenomenon of "snow blindness" may occur. There is no blindness, nor is snow a necessity for it. Dazzling is present, and occasionally amblyopia and a central color scotoma. There is no evidence that the threshold becomes higher after repeated exposures as is found for the skin.[2]

2. The effect on the iris.

The iris experiences some changes concurrently with the appearance of photophthalmia. Congestion occurs along with the presence of minute interstitial hemorrhages, miosis and fibrinous exudation into the anterior chamber.[2]

LeGrand considers these changes to be a secondary reaction of the iris.[1]

3. The effect on the lens.

The evidence for ultraviolet effects on the lens is inconclusive. Duke Elder claims that experimental lenticular opacities can be produced by ultraviolet only if the dosage is so massive as to induce gross pathological changes in the cornea and damage to the iris, and even then only occasionally and with difficulty. Kinsey[4] agrees, stating that damage to the lens by ultraviolet would require exposures three times that which cause keratitis. LeGrand was unable to produce effects on the lens of a rabbit using fluorescent tubes.[1] Fuchs[5] has recently noted that, although the

incidence of cataract is believed to be high in India it is probably not caused by exposure to large doses of ultraviolet. He points out that other areas have similar climatic conditions with no increase in the incidence of cataract. Additionally, if ultraviolet is the cause, then people living at high altitudes should experience even more lenticular disorders. This has never been shown. Fuchs concludes that nutrition is probably the cause rather than ultraviolet radiation. As opposed to this, both Rohrschneider[6] and Burge, Wickwire and Schamp[7] claim to have produced cataracts using ultraviolet "B."

Practically one could say that very little ultraviolet ever reaches the lens since most is absorbed by the cornea. Essentially all radiations below 300 $m\mu$ are absorbed and scattered by the corneal proteins, so there is only an insignificant amount of ultraviolet C, and very little ultraviolet B that ever reaches the lens. What does reach the lens is absorbed almost totally.[8] As age increases, this already sizeable absorption also increases. The absorption, especially of ultraviolet A does produce a slight heating action which is added to the heating action of the infrared rays.[1] Recently Langley, Mortimer and McCulloch[9] were able to show that heat, even when applied to the lens through the iris was sufficient to cause lens opacities. The significance of the ultraviolet contribution in this matter is not yet determined. Part of the difficulty in this problem arises because the basic cause of cataract has not yet been determined. Lowenstein[10] suggested that cataract may be produced by injury to the capsule increasing its permeability. Pau[11] more recently has presented evidence that cataract was due to an increased permeability of a functional membrane which consists of capsule, epithelium and the superficial stroma. Brindley[12] has also speculated that cataract may be due to an increase in permeability or to a decrease in the active pumping process in the membrane that is responsible for the potential. Sperelakis and Potts[13] have located a transcapsular potential that was markedly temperature-dependent and that was partially inhibited by ultraviolet light. These reactions suggest that the potential is metabolically dependent. Since the potential is decreased by ultraviolet and if a decrease in potential causes cataract it may be that the genesis of this affliction may be due at least in part to ultraviolet light. It will be interesting to note whether further research is able to prove or disprove this hypothesis since the problem is a formidable one that may involve cumulative effects over a number of years.[2]

4. The effect on the retina.

The ultraviolet that reaches the retina is weak thanks to the absorption by the media anterior to it.[14] This radiation is composed of only

the near ultraviolet A (almost all of it above 320 mμ). Kinsey[4] and LeGrand[1] feel that any effect on the retina is negligible. Duke-Elder[2] goes one step further, claiming that an abiotic lesion could not occur even in the absence of the lens. He states that, "on the whole it is probably safe to say that the ultraviolet radiations which might harm the retina do not reach it, and those . . . which do reach it have not been shown to do organic or functional harm of any practical importance to this tissue."

D. THE EFFECT ON VISUAL FUNCTION.

Severe doses of ultraviolet between 250 to 314 mμ may produce amblyopia and central color scotomata, both of which are symptoms of so-called snow blindness.[2] Ludvigh and Kinsey[15] found no effect on foveal light differential sensitivity or critical flicker fusion frequency even after very sizeable exposures to ultraviolet "A." Wolf[16] noticed that the dark adapted rod threshold was raised by exposure to light of 285 mμ. The cone threshold was not altered. In a later study he[17] found an impairment in visual acuity, contrast discrimination and frequency of seeing in the dark adapted eye after exposure to 280-380 mμ for three to four hours. Boeder[18] echoes the idea that although ultraviolet A is incapable of producing recognizable effects, it can lower the sensitivity of the dark adapted eye. Dodt and Walther[19, 20] noted that there was a discrepancy between the differential scotoptic sensitivity of the eye in the near ultraviolet and the electroretinographic sensitivity. This was attributed to the fluorescence of the lens. Klang[21] found that this fluorescence increased with diabetic cataract. He observed this increase even with slight incipient cataract. Wald[8, 22] has also taken account of the fluorescence of the lens in his analyses of the absorption curves of the photopigment when the eye is subjected to ultraviolet light.

E. PROPHYLAXIS

Since it has been established that ultraviolet can cause ocular disturbances, the diminution of this portion of the spectrum is sometimes desirable and necessary. Widmark[23] showed that clinical symptoms were prevented by a plate of ordinary glass 0.5 cm. thick. For exposures of ordinary intensity and short duration a pair of spectacles affords adequate protection, but for severe or prolonged exposures this is insufficient. Fleischer[24] found that ordinary spectacles are sufficient protection for casual wear in the presence of welding radiations. However, it is insufficient for welders or for those individuals who must be exposed to ultraviolet for prolonged times. LeGrand[1] is more cautious advising highly absorbing material for use in industry and therapeutics, and for all aphakics.

F. DISCUSSION AND SUMMARY

The only advantageous effect of radiation is found in the utilization of ultraviolet B and C for the production of vitamin D in the skin. All other radiation is known to be harmful, or is suspected of being harmful or is neither advantageous nor disadvantageous. The damage that can occur is largely confined to the anterior segment of the eye where inhibition of cellular mitosis has been observed[25] and where conjunctivitis and keratitis are occasional sequelae. Less agreement is noted for the damage to the deeper layer. Secondary effects such as congestion and minute hemorrhages have been noticed in the iris. Lens damage, although oftentimes attributed to ultraviolet, is not yet proven in the minds of many authorities. Massive doses probably will produce cataracts, but usually encountered amounts are generally considered to be harmless. New evidence has opened up the question again, however, concerning small but perhaps cumulative effects on the lens by ultraviolet. It is not yet possible to reach a definitive conclusion on this matter.

Small effects on function have been noted at the level of the retina, largely on dark adaptation. There seems to be little proof that permanent damage to the retina results from ultraviolet light.

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## ANNOUNCEMENT

### BVI AD SCORES

Better Vision Institute's first advertisement in its new program of public education, in the October 24, 1960 issue of LIFE Magazine, attracted nearly three times as many readers per dollar as the average of all advertisements in that issue. So reports Daniel Starch & Staff, leading advertising research firm.

Of 66 advertisements in that issue which were measured, only 9 outranked the BVI ad among men readers and only 19 among women.

The BVI ad was one of 12 full-page, black-and-white ads without "bleed." Only 3 of these outranked BVI among men, only 1 among women.

These measurements are all in terms of people who actually read at least half of the body text.

No single report of this kind is sufficient basis for firm or far-reaching conclusions. But considering that BVI's message asks people to face a possible deficiency in themselves, and that it must compete with such attractive subjects as new cars, transistor radios, food and fashions, it is an encouraging indication of sound advertising strategy.

# ESSENTIAL IRIS ATROPHY*

Harold L. Friedenberg†
Richmond, Virginia

On occasion the optometrist is afforded the opportunity of observing and following the course of a pathological condition so rare and unusual that it becomes of greater than passing interest. Essential iris atrophy is such a pathological entity and it is the purpose of this paper to discuss the history, etiology, and symptomatology of this disease and to report on two cases observed in the writer's practice.

According to Duke-Elder[1] essential or progressive atrophy of the iris is a unilateral disease of unknown etiology characterized by a slowly progressing atrophic change in the tissue of the iris which leads to the complete disappearance of portions of the tissue and ultimately ends in blindness from absolute glaucoma. It is reported that the disease usually occurs in early adult life, but at least one case has been reported at 54 years of age. Its etiology is generally unknown but there has been a great deal of speculation as to its cause. One of the earliest papers on the subject was that of Feingold[2] in 1918 and it remains a classic. Prior to Feingold's contribution most authors felt that the vascular changes and the accompanying iris atrophy were the result of glaucoma rather than the cause. Feingold held the reverse to be true because when vascular changes of the iris occur in glaucoma they are not limited to one portion of the iris. Vascular changes in essential iris atrophy are limited to the ciliary portion of the iris. The atrophy of the iris in glaucoma generally begins at the sphincter portion of the iris and atrophy of the iris associated with glaucoma only rarely extends throughout the whole thickness of the iris.

In 1926 de Schweinitz[3] cautioned against confusing congenital aberrations of the iris such as polycoria, coloboma and aniridia with essential iris atrophy, which is not congenital and which is progressive. He looked upon the atrophy as a manifestation of a circumscribed shrinking of the iris by some pathological process or by assuming a primary atrophy of the iris, a condition in which the pupil would naturally be drawn to the side where the iris is less atrophic. Cyukrasz[4] hypothesized that its cause lay in the embryological dynamics which set into motion the pupillary evolution in the fourth month of fetal life. He

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stated that at times the process finished before the pupil was completed and a persistent pupillary membrane was formed. The conclusion was reached that the regressive function of the iris is influenced by an inhibitory factor, and Cyukrasz felt that the solution to the etiological puzzle of essential iris atrophy will be fully discovered only when more knowledge is available on embryological and biological occurrences.

Also advanced is the theory that the mechanism causing resorption of the pupillary membrane becomes reactivated in later life and attacks the normal iris tissue. The glaucoma is then thought to be produced by the cellular debris suspended in the anterior chamber, causing an occlusion of the chamber angle. Von Grosz[5] believed the primary etiological factor to be an iris of inferior quality. He suggested that the disease process may begin with atrophy in one portion of the iris with the healthy part exerting a pull on the atrophic portion until it becomes torn. The glaucoma is secondary, caused by the pigment debris clogging the iris angle, with the resulting increase in tension aggravating the process.

Fine and Barkan,[6] in discussing the secondary glaucoma which ensued, referred to the dense peripheral anterior synechiae which were found in the few instances in which anatomic examination was performed. Sugar[7] reported in some detail on the formation of peripheral anterior synechiae which occur in nearly all of the fifty-one cases reported. These synechiae are caused by migrating pigment cells and block the drainage angle. In this process, according to Rones,[8] the iris root is actually soldered to the periphery of the cornea, beginning at a circumscribed spot and leading to a displacement of the pupil. This pulling of the iris is thought to cause a distention of the anterior layers of the opposite side, resulting in atrophy and finally a tearing of the stroma and the pigment layer. The slowly progressing obliteration of the chamber angle finally blocks off the aqueous drainage and produces glaucoma.

In June of 1940 Henderson and Benedict[9] reported a case which was of particular significance because it was observed prior to the onset of glaucoma and warranted a definite diagnosis of essential progressive atrophy of the iris. In addition to their own case Henderson and Benedict reviewed 28 other cases and divided them into three groups. Group I included 12 cases observed prior to the onset of glaucoma. Group II included cases observed after the onset of glaucoma. In neither of the groups was any etiological factor determined. In group III were included those cases which might be considered other than those of essential progressive atrophy of the iris. In the first two groups the age of onset

of the iris defect varied from 20 to 49 years, averaging about 30 years. In all but 2 of the 12 cases, glaucoma eventually developed from slightly less than one year to 8 years. Only 2 of the 12 patients were males.

Since anatomic studies have been made only on those eyes enucleated in late cases in which the disease process has practically run its course, the only early evidence of the changes in the chamber angle has been obtained through gonioscopy. Peripheral anterior synechiae seem to have been observed in almost every reported case. In a few cases it has been reported that the entire iris disappeared, but despite this the first sign of the disease noted by the patient is frequently only the pain caused by the secondary glaucoma.

McKeown[10] suggested that some constitutional fault might be an etiological factor in this disease but he further stated that the preponderance of the case reports has indicated that the general physical examination of the affected patients resulted in negative findings. The onset of the disease is insidious and without pain. It usually begins with a distortion of the pupil. Following this, holes begin to appear in the iris which eventually enlarge so that only a few strands of iris stroma remain with large apertures in between. The intraocular tension begins to rise because of the blockage of the drainage canal. Until the time of the symptomatology induced by the increase in pressure there are no clinical symptoms and the glaucoma which results is usually quite resistant to drugs and surgery.

CASE REPORTS

Case 1.

C.A., a white male, twenty-four years of age and in apparent good health, was first seen on September 7th, 1957. He worked as a clerk for a motor freight line and his chief complaint was of frequent frontal headache, photophobia and a vague tiredness in the ocular region while doing the close work necessitated by his occupation. He also reported that both he and his wife were disturbed by the irregular shape of the pupil of his left eye. External observation showed a pupil of normal appearance in the right eye, while the pupil in the left eye appeared to be roughly triangular or "pear-shaped," with the apex directed to six o'clock and extending closer to the iris root inferiorly. The vertical diameter of the pupil was roughly twice that of the horizontal diameter. The general appearance of the iris was not unlike that of an anterior synechia. The responses of both pupils to direct, indirect and accommodative stimuli were full in amplitude and rapid in response. Other findings were negative. The patient was refracted, found to have

a moderate amount of compound hyperopic astigmia, and lenses for all near point work were prescribed.

The patient was next seen on October 3rd, 1958, at which time he expressed concern over "black spots" which were visible when he looked at his eye in a mirror He also complained of photophobia which was considerably more severe in the left eye than in the right. The black spots to which he referred were holes in the iris at 11, 12, 1 and 2 o'clock. (Figure 1.) These defects extended to the frill and varied

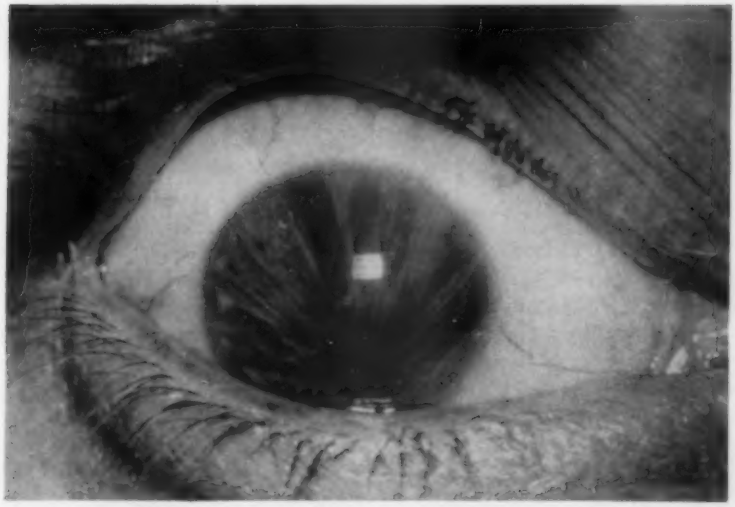

Fig. 1.

from 2 to 4 mm. in width. The holes were separated from each other by iris tissue and within the holes could be seen a number of tremulous strands of iris tissue. In using the retinoscope the retinal reflex could be clearly observed through each of the holes as well as through the eccentrically shaped pupil, and each of the pupils responded simultaneously to the light stimulus. The fundus could be viewed ophthalmoscopically in the same manner. No attempt was made at a diagnosis other than a non-inflammatory deterioration of iris tissue and the patient was referred to an ophthalmologist.

According to the patient, the ophthalmologist informed him that the iris tears were of congenital origin and referred him to a geneticist, then back to the writer for refraction. Lenses were again prescribed, primarily for near work, but since the iris holes in the left eye con-

tributed so much to pupil size it was decided to use a #1 tint in the right lens and a #2 in the left.

A telephone call from the patient on April 3rd, 1959, was the next contact. He was concerned by the appearance of additional tears in the iris structure and by an enlargement of the existing holes. He was referred to a second ophthalmologist who made the diagnosis of essential iris atrophy. Originally the tension as measured by the Schiotz tonometer was equal in the two eyes, but subsequent monthly readings indicated a steadily increasing pressure in the left eye. Gonioscopic examination revealed the presence of peripheral anterior synechiae. At the present writing tension is apparently being controlled by medication.

Case 2.

Mrs. J.S., a 52-year-old female, was seen on May 12, 1959. This patient had no ocular symptoms but felt the need for visual examination because a friend questioned her about her right eye being blue and the other black. The only visual symptoms which could be elicited were those of presbyopia. The patient reported having been in an automobile accident on March 10th. She suffered a slight head injury and her face was struck, but not cut, by fragments of the windshield. It is interesting to note that this degenerative iris condition which certainly required a number of years to advance to its present state, was completely unobserved by the patient until her attention was called to it by someone else. Upon becoming apprised of the loss of iris tissue the patient attempted to relate it to the accident.

The clinical picture was that of an essential iris atrophy of long standing. Figure 2 shows an iris which has almost disappeared. A triangular patch of atrophic iris extends from 12 o'clock to 2 o'clock with its apex directed approximately 4 mm. in a posterior nasal direction. A thin tremulous strand of tissue joins it to the iris root at 7 o'clock. There is almost complete destruction of the remainder of the iris. The tissue which is present reacts to stimulus directly, consensually, and to accommodation. An appointment was made for the patient with an ophthalmologist and she was seen on May 12, 1959. On this date the ocular tensions were Right 15, Left 19. On May 28, 1959, the tensions were Right 14, Left 19, and on June 25, 1959, Right 15, Left 26. The case was diagnosed as essential iris atrophy. Shortly thereafter the patient moved to another city and it has been impossible to follow the course of the disease.

## SUMMARY AND CONCLUSIONS

A discussion of essential iris atrophy has been presented and its etiology, symptomatology and sequelae have been discussed.

Fig. 2

Optometrists are urged to differentiate this condition from one of congenital origin becaue of the certainty of secondary glaucoma as a concommitant.

Two case histories encountered in the writer's practice have been presented.

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# THE USE OF PLEOPTICS IN ORTHOPTICS*

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Since the introduction of Pleoptics in 1954 by Dr. Bangerter of St. Gallen, Switzerland, the ophthalmic world and especially the ophthalmological part of it, has been buzzing with excitement and anticipation. The excitement was caused by the sound methodology, which the pleoptic procedure encompasses. The anticipation, as is the case with all presumably new ideas, is in the hope that at last a method has been found by which strabismus, and particularly amblyopia, might be conquered. Unthinkingly, perhaps, those who took up the cudgels for pleoptics and the theory behind it, overlooked one very important fact. The procedures which pleoptics is supposed to encompass and include, are not new. They were introduced back in 1935. They appeared in a series of papers which I wrote for the AMERICAN JOURNAL OF OPTOMETRY. The issues referred to are those of June, August, October and December, 1935, and January, 1936. Other papers followed on this subject in close succession and over the years, in which the theme of *combined, multiple* treatment processes, elimination of amblyopia and suppression, reduction of subnormal visual acuity and its improvement to as high a level as possible, were predominant steps. Teaching and developing foveal fusion was the last, though by no means the least important factor in my treatment procedure. This clinical procedure and treatment philosophy permeates all my teachings and writings and is the basis for the procedures in both editions of my book, *Clinical Orthoptic Procedure*. One difference between my procedure and the one introduced by Dr. Bangerter is the name, or title. Mine was a "re-educative procedure"; Bangerter calls his "pleoptics." One other difference, in the pleoptic method patients are hospitalized for treatment: ours are treated at the office or clinic.

However, from all indications, pleoptics, as a basic treatment procedure, is becoming very much entrenched, both here and abroad. Ophthalmology and its subsidiary, the orthoptic technician, are accepting this procedure without equivocation. It behooves us, then, to examine this procedure step by step and to evaluate its efficacy not only as office and clinical routine, but also to a limited extent, perhaps, as a supplemental home treatment.

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Heretofore, the most potent tool for treating amblyopia and suppression, in the hands of the medical and optometric orthoptist, has been occlusion. This was prescribed indiscriminately in all cases of suspected amblyopia. In some instances, this was a helpful procedure; in others, it was more harmful than useful. Harmful, because in cases of anomalous retinal correspondence, occlusion tends to intensify the anomaly, rather than eliminate it. Even in those cases in which occlusion of the non-amblyopic eye seemed to be helpful, the amount of amelioration was of questionable quantity, quality, and long term retentiveness. It was most helpful only when supplementary forced usage of the amblyopic eye was combined with occlusion of the non-amblyopic eye.

And even in the practice of occlusion, there was no one uniform method. On the pretense of preventing development of eccentric fixation, some practitioners and technicians occluded each eye alternately. Some advised occlusion only for a specified period of time, either daily, on alternate days, or once every so often. Prevention of eccentric fixation was given as the reason for such haphazardness and variability. The length of time for occluding also played an important and interesting part. Some advised occlusion of the non-amblyopic eye for an hour daily. Some increased the time from half a day to a whole day. Still others increased it to as long as a week at a time. In short, occlusion was practiced in a helter-skelter manner. A substantial reason for it was evidently lacking. It could not be explained on the basis of physiology or visual psychology. Also inconsistent were the means used for occluding an eye. It varied with the popularity a particular appliance attained because of mention given it in a particular article by a writer of renown.

Aside from occlusion and fusion training which either followed in succession or concurrently, nothing else was done by way of training. The fact that the suppressing visual system was unprepared to convey images to the higher cortical centers, seemed to make no difference, or the importance of eliminating suppression was not understood. And so, the procedure followed by many well intentioned medically oriented orthoptists and ophthalmological practitioners was:

1. Occlusion, either total or partial, of long or short duration; the non-amblyopic eye only, or alternate eyes. 2. Fusion training. If visual acuity failed to improve and fusion did not develop during a pre-determined time, surgery was done. Some resorted to post-surgical orthoptics; others, using the pre-surgical orthoptic failure as a criterion, refrained from following up the surgery with any corrective pro-

cedures other than repetitive surgery. The few who spoke out that this was a faulty approach and an erroneous procedure, were voices crying in the wilderness. One man who knew the cause was Dr. Walter B. Lancaster. In his tract, *Fifty Years Experience in Ocular Motility*, he states:* "An important and comparatively recent chapter of strabismus deals with secondary correspondence, anomalous correspondence, anomalous projection. Orthoptists tell me that this is *terra incognita* to most of the ophthalmologists with whom they have to deal. . . ." (end of Dr. Lancaster's quote.)

*5, 6 & 7, May, June, July, 1941, p. 743.

The accepted teachings of the day could not be disputed, and, as Nicholson** aptly put it, "When a tradition once becomes established by the hallmark of acknowledged authority, it takes more than cold facts to uproot it from man's mind—it takes time." It seems that the acknowledged authorities of that era set down the accepted procedures. Few dared to dispute them. Men were groping in the dark!

In the optometric camp, modalities were somewhat more rational. Even though optometric practitioners had less access to strabismus cases than the ophthalmological practitioners, they tried all means, both orthodox and unorthodox. They were not restrained by acknowledged authority. They experimented; they copied; they accepted and tried everything and anything that held out any semblance of promise. And so, a fairly large body of procedures grew up for developing visual acuity, even though the mechanics of what produced subnormal acuity was not known. While that phase of binocular perception now known as retinal correspondence reposed in pages of earlier writers, it awaited resurgence by men like Bielschowsky, who introduced Hering's process for testing this function. While the law of muscular innervation, now known as Hering's Law, also was lying dormant in the pages of text books and tracts, men like Peckham,† in 1931, unknowingly, tried to stimulate the extra ocular muscles with what he termed, "irritating prisms." True, today's knowledge would consider such treatment unscientific, but at least Peckham attempted what he thought would get results. He wasn't content to sit by and wait to follow the leader. He gave those who followed him, an incentive to do more research. What followed were papers and books based on solid clinical investigation. What also followed, unhappily though, were cults and cultists. In an eclectic profes-

*Lancaster, W. B. Fifty Years Experience in Ocular Motility. Am. J. Ophthal. 24:

**Nicholson, W. "Historical Sources of Dafoe's Journal of the Plague Year." Boston, Stratford Co., 1919.

†Peckham, R. M. Squints and Heterophorias. Privately published, 1931, Rochester, N. Y.

sion, such as optometry, this was unavoidable and inevitable. Cultism based on uncontrolled research can get out of hand and this is precisely what happened in the early days of optometric orthoptics. But this is something I shall not go into at this time.

In the AMERICAN JOURNAL OF OPTOMETRY, beginning with the June, 1935, issue, and running, respectively, through the August, October, December, 1935, and January, 1936, issues, I wrote a series of articles entitled *A Basic Technique in Orthoptics.*†† This contiguous series introduced to the profession for the first time a new method and an array of home made instruments, for treating strabismus, in which the side effects such as amblyopia, suppression, anomalous retinal correspondence and all the other associated abnormalities were treated first. Treating and developing binocular functions and fusion, were left to the very end and considered as the least important phases in the treatment. This was a contrary departure from the accepted mode of therapy. It relegated occlusion to a place of secondary importance. Fusion training was made the end result rather than the primary function. As was expected, such unorthodoxy raised quite a furor in some circles, especially when I advocated commencing fusion training at the point of orthophoria instead of the existing angle of deviation. Yet, there were some practitioners in both schools, who saw merit in my procedure. They followed my methods and obtained astonishing results.

To formulate the procedure which I introduced in the series, *A Basic Technique in Orthoptics*, which, incidentally, was later incorporated in the two editions of my book, *Clinical Orthoptic Procedure*, I inaugurated in my office, a program of free services to patients with muscle defects. These I treated without fee, using the methods available at the time, also trying new ideas and procedures. I started this program in 1928 and carried it through with some degree of success, until I organized, in 1933, the orthoptic clinic at the eye department of the Boston Dispensary, New England Medical Center. There I was given a free hand in administration of the clinic, which included choosing assistants. These I selected from among the seniors at the Massachusetts School (now college) of Optometry. I was also given a free hand in the selection of patients. In these, we made no choice. We took them as they came. We wanted to decide for ourselves, after trial and error, as to who might and who might not be helped: which cases would and which would not respond to our treatment procedures. Many eastern

††Also, appeared in 1947-48 in the Optical Journal & Review of Optometry, in greatly expanded content, in serialized form, under the title "Clinical Procedure in Orthoptics."

ophthalmological orthoptic clinics accepted and used the methods I introduced. To these, they also added some of the methods made popular at about the same time by some British orthoptists, following the introduction of procedures in France by Cantonnet and Filiozat. Optometric clinics were sharply divided on procedure. Some used my methods with reservations, retaining some of their former methods, as well as the teachings of Peckham and others, including the French and British schools. Others followed the newer teachings which sprang up on such procedures as syntonics, chrome-orthoptics, myoculator, squint korrector and others.

This, and the fact that some of the accepted procedures could not be explained by the acknowledged scientific theories, the clinical methods of orthoptics continued in a sort of perpetual state of flux. And so, new concepts were introduced, accepted for a while and discarded just as rapidly. This became a routine procedure. In 1954 a change took place. In that year, Bangerter introduced the procedure which he named Pleoptic.

What is Pleoptics? How does it differ from the other procedures? How does it differ from the procedures which I introduced in 1935? The works of Peckham? And the procedures of those who preceded him both in this country and abroad?

The pleoptic method of treatment is basically a monocular method consisting of procedures for eliminating false macula and eccentric fixation by covering the macular-foveal area and then bleaching and inactivating the surrounding retina with strong illumination. The blocked-out macula is then manifested spatially as an after-image.

Maynard C. Wheeler* in the July 1955 ARCHIVES OF OPHTHALMOLOGY, in his Annual Review of Strabismus, states: "It is not surprising that this method of treating eccentric fixation has been readily accepted, because no other treatment has been known."

To be most effective, the component parts of a specific orthoptic program must be so set up that they would follow very closely the natural development of the very functions which are being rehabilitated. Foremost of these are processes for restoring the rudimentary visual and perceptual functions, and eliminating sensory blocks and suppression, if such exist. Elimination of amblyopia and improving visual acuity is possible only if such a procedure is followed. It is here that the pleoptic phase of orthoptics fits in.

Also, since the vast majority of strabismus and amblyopia patients

*Wheeler, M. C. Annual Review: Strabismus: A. M. A. Archives Ophthal. 54: 1: 100-134, July, 1955.

are young children, the most successful procedure is one in which the component processes and steps are compatible with the child's comprehensive capacity and interest span. Procedures made into games, and treatment material designed with that in mind tend to make training acceptable rather than a chore which even many a docile child might find boring.

Moreover, an effective and efficient orthoptic procedure is one in which the various component steps are integrated and follow in contiguity without leaving a void in the functional performances of the visual act. Such a void must first be overcome before we attempt teaching fusion when there is macular-foveal suppression and block in the visual reflex arc, and/or amblyopia. Similarly, it is a waste of time and effort to attempt teaching the higher visual functions, such as bifoveal and stereoscopic perception, if tests indicate presence of abnormal retinal correspondence—with the slightest vestige of amblyopia or suppression, or, even if there is only a defect in retinal correspondence.

The pleoptic routine takes all this into consideration. But so does the re-educative routine of which I spoke earlier. An important feature of the brand of pleoptics Bangerter is advocating and which is claimed to be productive of most gratifying results, is placing amblyopic patients into eye clinics as ambulatory in-patients and giving them treatment several times daily, for lengthy periods at a time. This, of course, is only feasible in countries where such treatment to the patient is free. This phase of giving lengthy and frequent treatment has been advocated by me repeatedly.**

The term pleoptics is derived from the Greek "Pleon," which means more, or greater, or "pleos," which means full, or complete. The noun optic added to it gives us the full meaning of the word "pleoptics." Dr. Bangerter, of St. Gallen, Switzerland, introduced the term as well as the procedures now used widely in Europe and becoming increasingly popular in the United States.

An array of new instruments has also been developed specifically for the practice of pleoptics. Notable among these is the Visuscope and Pleoptophor† by Bangerter and the Euthyscope, by Cueppers. In addition, there is the Coordinator, the Alternoscope and instruments for inducing and training hand and eye coordination, and hand and sound coordination. These instruments are used primarily for uniocular train-

**Smith, W.: Clinical Orthoptic Procedure, The C. V. Mosby Co., St. Louis, Mo. Ed. 2, p. 114; ed. 1, p. 71.

†The Pleoptophor is a more complicated and costly instrument than Cueppers' Euthyscope and, like *it*, is used for both diagnosis and treatment.

ing. The Maddox tangent cross is also used with the euthyscope for determining the degree of foveal projection. The Maddox cheiroscope, the bar reader, and the different type synotype instruments such as the synoptiscope, are used for binocular training and fusion development, but only after normal monocular functions are fully established. Additional apparatus used in pleoptics is a large, white screen, or an x-ray viewer type screen, a black cross, or some other simple object to be attached to the white screen as a fixation target, a deflecting mirror, Snellen test chart and an inverted "E" test chart for determining visual acuity, Swedish hand test and individual letters "E" of varying sizes, for determining angular visual acuity, pleoptic games, projection plates, tracing board or instrument and occluders.

The main objective of pleoptics is to establish clear, constant and unobstructed foveal fixation and perception. By so doing, it is intended to help both directly and indirectly, to eliminate suppression and amblyopia and help improve visual acuity and keep it improved. With this as the purpose, it is logical to assume that the higher perceptual and binocular functions would also benefit. At the beginning, such improvement may be transitory, becoming permanent as treatment progresses.

As foveal suppression is eliminated and the foveal areas resume normal functional performance, fusional movements, upon which bifoveality depends, also become fully developed. Therefore, fusion training, which follows in due course, must also, from the very beginning of development, be at the foveal level. This is the method I have been advocating.* Now it is part of the pleoptic teachings.

Based on definition, pleoptics means training visual functions in which macular-foveal development plays the primary role: elimination of amblyopia, the most important objective. The steps in the procedures used are composite and congruent. They fit one function into another very closely in a dovetail fashion.

Since the visuscope and euthyscope play such a vital part in pleoptics, let us digress and consider these two main instruments, what they are, how they are used, and what their findings indicate. The visuscope is used mainly for diagnosis, the euthyscope is used for treatment.

Being primarily a diagnostic instrument, the visuscope is used for differentiating foveal amblyopia from amblyopia with eccentric fixation. The former type is known also as suppression amblyopia. The latter is the type of amblyopia in which anomalous retinal correspondence

*Smith, W. Clinical Orthoptic Procedure. The C. V. Mosby Co., St. Louis, Mo. Ed. 2, 1954, pp. 121, 127. Ed. 1, 1950, pp. 77, 83.

predominates, caused by the eccentric fixation. Although both are of the exanoptic type, the therapy used in each is different. In amblyopia with foveal suppression, occlusion is a beneficial mode of treatment. In the amblyopia with eccentric fixation, occlusion alone, as a specific remedy, is contra-indicated. It is held that such a procedure is apt to intensify and reinforce the eccentric fixation rather than eliminate it.

The visuscope is basically an ophthalmoscope with a system of projected test marks. One of these marks, and the most useful one in the pleoptic examination, is a little star. The visuscope light with the central star is projected on the retina. In normal cases, fixating the instrument light, directly, tends to place the macula in the examiner's direct line of vision. The star would then fall on the macula. If the overly bright light of the instrument produces glare, reduced illumination helps to prevent that. In steady central fixation, the star is consistently impinged on the macula. When the star tends periodically to stay on the macula and move off it, fixation is macular, but unsteady. In this it differs from eccentric fixation, which may be either very close to the macula, at the periphery, or any place between the macula and the disc. In such cases, foveal fixation is invariably absent.

In cases where anomalous fixation is manifested, or central fixation is completely absent, it is necessary to occlude the amblyopic eye for at least one month before any after-image treatment is started. Such occlusion may produce one of the following results:

1. Eccentric fixation may remain unchanged.
2. Eccentric fixation may become less extensive and intense.
3. Fixation may become foveal.

Occlusion of the amblyopic eye must be continued until fixation becomes foveal.

Therefore, it is advisable to continue occlusion even if no alteration in fixation is manifested after the eye is occluded for a week or longer. Persistence often results in favorable change of this function. It is imperative in all such cases, to wear occlusion at all times, except during the periods of actual treatment.

The euthyscope, developed by Dr. Cueppers, also resembles the ophthalmoscope in construction. In addition to an optical and light projecting system, the euthyscope contains a green filter, a polaroid disc, and two other discs, each with a dark center dot. These are of two different sizes, one 5°, the other 3°. These discs are used for covering and blanking out the fovea.

Pleoptics uses the after-image produced by the euthyscope as the basis for treatment of amblyopia. For best results, the pupil of the

eye under treatment should be dilated prior to treatment, though this is not a prerequisite for a successful outcome.

The euthyscope illuminates an area of 30° in the fundus. In the center of this projected light, corresponding approximately to the center of this area, is the black spot of 3° or 5°, mentioned earlier. Either one of these spots is projected on the macula where it acts as a shield and protects it against stimulation. When the light is turned off, an after-image is produced. The 5° black spot is used unless the point of eccentric fixation is within the 5° area. In such cases, the smaller 3° spot is used. The green filter in the euthyscope produces a red-free light area which helps the examiner to localize the macula more readily without producing interfering glare. The green filter is removed as soon as the macula is localized and the 3° or 5° black spot is projected to cover the macular area. The spot thus tends to protect the fovea. The fixating eye is occluded.

To make certain that the eye is fixating as directed, the non-amblyopic eye also is directed to look straight ahead. As the fovea of the amblyopic eye is occluded by the black spot, the extra-foveal area is dazzled with the strong white light of the euthyscope. It is approximated that by this procedure, about 30° of the retinal area is dazzled, while the foveal area of either three or five degrees is spared, depending on the size of the spot used. The foveal area becomes manifested as an after-image.

The light from the euthyscope is projected into the eye for not more than 20 to 30 seconds. The patient is then directed to look at a white screen situated at an arm's length and report if an after-image appears.

The after-image may be either positive or negative. The positive after-image appears as a dark central spot with a light peripheral field. It signifies that the foveal area is blocked and suppression is present.

The negative after-image is manifested as a clear central spot, corresponding to the foveal area. It means that suppression is absent, and the fovea is functionally active.

A normal eye will have no difficulty in seeing the after-image. The amblyopic eye with macular suppression may have difficulty in seeing it. The eye with eccentric fixation may see the after-image at an off-center position.

In such cases, an instrument called the alternoscope is found to be very helpful. This instrument produces flashing lights which can be regulated and varied in intensity, speed, and frequency. These flashes are alternated by periods of darkness of equal duration and frequency.

Hence the name alternator. The light is projected on a large, white screen. The deeper the suppression, the more intensified the flashing must be. The flashing method, it is claimed, helps to bring about manifestation of the after-image. At the beginning, it may be a positive after-image. However, with persistence and conscious effort, the suppression may be eliminated and a negative after-image may become persistently manifested. In case of periodic fade-out of the after-image, repeated shutting and opening of the eyes may reactivate the after-image.

Teaching of spatial projection is a part of this phase of treatment. The after-image produced by the euthyscope can serve as a means of determining spatial localization. In the normal state, the image will be perceived as located straight ahead. In eccentric fixation, it will appear off center. A simple fixation object, such as a cross, or a letter "E", may be used to check position of fixation. The object is attached to the screen in the patient's direct line of fixation, and position of after-image is determined and recorded. The Maddox tangent cross may be used for the same purpose. With this instrument, it is possible also to keep a record of angular special displacement, if such exists. The center light is used for fixation and the numerals on the cross serve as the areas for recording. In either case, the patient is encouraged to try to place the after-image on the center of the target and to have it remain there as long as fixation is active. Spatial projection must be normal before any attempt is made to improve visual acuity. The training of special projection can be carried over to, and made a part of the visual acuity training phase. As the patient is perceiving characters on the visual acuity chart, he can simultaneously try to place the after-image in the center of the respective letters.

In cases of anomalous retinal correspondence, which the visuscope tests show as eccentric fixation, a new training instrument, the coordinator, may be used, which utilizes the phenomenon of projected Haidinger's brushes. As is known, Haidinger's brushes is an entoptic phenomenon of polarization. In addition to being a testing device for determining eccentric fixation, these brushes are also helpful as a treatment for eliminating such abnormal fixation, as well as anomalous retinal correspondence. This is not possible either with the euthyscope, or visuscope. The coordinator is designed primarily for improving foveal projection and fixation at the near point.

If fixation is central, Haidinger's brushes will be seen in the straight ahead direction, in line with the subject's direction of gaze. If fixation is eccentric, projection of the brushes will also be eccentric or abnormally

placed. The brushes will appear to be projected to a side, depending on the area and degree of displacement.

In cases where fixation is macular or even paramacular, but the function is unsteady, use of the coordinator may help to restore normal fixation. Hand and eye coordination is the basis for this treatment. Haidinger's brushes, visible only at the fovea, are the target. The patient is instructed to fixate and place the brushes on a target such as the tip of a pointer, which is placed in his line of vision, and which he controls manually. The eye under treatment must be so controlled that the two images are coordinated and superimposed.

The one difficulty which may be encountered is that as the eccentric retinal area is being stimulated, disturbing visual side effects may be produced. This may be in the form of persistent diplopia. Also, during the early stages, central fixation still being relatively under-developed, there is a possibility of its slipping, relapsing and reverting to its former state. Hence, it is advisable, in the incipient stages, especially, to occlude the amblyopic eye periodically. As foveal performance becomes intensified, occlusion is switched to the better eye, and as fixation becomes habitually foveal, the amblyopic eye is then subjected to intensified treatment for visual development.

The playing instincts of a child are utilized in the vision development phase of the pleoptic procedure. Here, treatment may be in the form of simple reading, putting-together games, drawing, tracing and so on. The better eye is occluded.

The use of sound producing gadgets, together with hand and eye coordination, are procedures used in the monocular training phase. One such procedure is by means of a projection plate, in which a buzzer or a bell announces correct or faulty performance.

When the patient is ready for the binocular phase of training, coordinated use of the hand and eye as a primary procedure of training, as with the cheiroscope, is utilized. In addition, the synotype instruments are used for training binocular and bifoveal functions.

It must be remembered that pleoptics is only one phase of orthoptics. It doesn't supplant or replace it. It is the beginning phase. As the abnormal and subnormal visual and perceptual functions become corrected and improved to a point of retentiveness, and the visual system becomes ready for the performance of the binocular functions, the secondary phase of orthoptics must be started promptly, and followed up in an intensified, persistent manner. However, during this phase, it is equally important to keep the primary functions in a constant state of consummate activity and repetitious performance, while adding to

them the advanced phases of training. Both must be integrated into a normally functioning system and kept that way throughout the treatment until visual functions become habitual and are no longer merely learned, acquired and parroted functional performances.

6715 SAUSALITO AVE.
CANOGA PARK, CAL.

## IN MEMORIAM

Anno Domini
1960

Dr. Albert Fitch, Philadelphia, Pennsylvania
Dr. Carsten Glahn, Oakville, Ontario, Canada
Dr. Ernest Hutchinson, South Pasadena, Calif.
Dr. E. J. Moshier, Kalamazoo, Michigan
Dr. F. G. Ottaway, Toronto, Ontario, Canada
Dr. Ernest Petry, Rochester, New York
Dr. William A. Sherard, Columbus, Ohio
Dr. Arthur Tillisch, Minneapolis, Minnesota
Dr. P. A. Wilkinson, Wellington, Ohio

Since our last meeting I regret to report that the Academy has lost nine members through death. Each of these members played a significant part in the development of the profession and each has left an important mark upon optometry. Three of these members headed important optometric schools and colleges. All of these members have been active in the Academy. We miss these important leaders and the membership of the Academy at this time pays tribute to their memory.

(From the minutes of the San Francisco, California meeting of the Academy.)

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Vol. 38 January, 1961 No. 1

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Dr. Monroe J. Hirsch ..... *Associate Editor*
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## NOTES ON ACADEMY PROGRESS*

Under the direction of President Fitch and a strong Executive Council, the Academy has just concluded another fine year in which the organization has not only met its goals, but in addition has strongly emphasized its leadership in the field of post-graduate education.

Academy committees have each played a part in this worthwhile program. The San Francisco meeting with a full schedule of outstanding papers is a tribute to the Academy and its work. The 75 Post-Graduate Courses just concluded emphasize the leadership of the Academy in this phase of our work. The 1960 successful launching of the Home Study Course series with the Shlaifer book on glaucoma is the start of a far-reaching program. The continued leadership of the Academy journal as a media expressing the best in optometric literature, and the outstanding clinical program of our five Sections are indicative

*From the Annual Report of the Secretary.

of the stature of the Academy and the contribution this organization is making to optometry and to the science of seeing.

A review of Academy activities would not be complete without an expression of thanks to the Papers and Program Committee under the leadership of Drs. Springer, Zettel and the five Section Chairmen, Drs. Shlaifer, Graham, Schumann, Schapero and Peters. This group started their work in the early spring of this year and here in San Francisco we will enjoy the benefits of their endeavors. The entire Academy is most grateful.

In addition we must acknowledge our tremendous debt to Dr. Ellerbrock who, with his committee, year in and year out has planned and supervised the Post-Graduate Course series. This is a tremendous activity and one of the real accomplishments of the Academy. Here, too, we are most grateful. In addition we thank past president Hummel who, with his committee, has handled all of the thousand and one details relating to the administration of the courses:—the pre-registration of those who attend and also the sale of tickets during the program itself. Dr. Hummel, like Dr. Ellerbrock, has been active in this activity since its inception and all of us will be forever in debt to them both for making this program such a success.

As is now well known, the book *Synopsis of Glaucoma for Optometrists* by Arthur Shlaifer has had nationwide acceptance and its sales have exceeded our expectations. In large part, credit for this, of course, must go to Dr. Shlaifer as his handling of this text material is in every way masterful. We expect the book will go on selling, not only in 1961, but in the future as well. It is a real contribution to the literature and we thank Dr. Shlaifer for the splendid part he played in writing this material. We are also indebted to Dr. Meredith W. Morgan who is Chairman of our Home Study Course Committee and to our Home Study Course publishers, The Burgess Publishing Company of Minneapolis for their help in printing the volume and marketing it. We look forward to working with these fine people in the future.

Here in San Francisco our five Sections will each do much to stimulate and inspire our members. Each Section has its own fine program and as usual all members and guests are free to attend the Section meeting of their choice on Sunday, Monday and Tuesday. Programs for these meetings are now being distributed at the registration desk.

BEVERLY MYERS ACHIEVEMENT AWARD

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American Board of Opticianry. As this award to me mentioned my work as Secretary of the American Academy of Optometry and also my activities as editor of the AMERICAN JOURNAL OF OPTOMETRY, a mention of this honor belongs in this report. The awards were presented by Mr. Leslie W. Myers, Minneapolis, former Board Chairman of the Benson Optical Company who spoke in high praise of the splendid achievements of the Academy.

MEMBERSHIP

Since our last meeting at Chicago, Illinois, membership certificates have been issued to 75 optometrists, educators and scientists. On November 1, 1960, the membership of the Academy numbered 961. This is the high point in Academy membership. In addition, there are, on November 1, 1960, 138 active applicants in the hands of our Committee on Admittance.*

THE SAN FRANCISCO MEETING

At this point in this annual report, mention must be made of the splendid cooperation we have received from the Bay Area Chapter and the Southern California Chapter, in promoting this meeting and helping to lay out the plans and make the arrangements which we are now following. The Bay Area Chapter has naturally had the largest role to play in this work and the members of this Chapter have fulfilled their function perfectly. To all of these fine California members we are most grateful.

In addition I wish to express to the Officers and Staff of the California Optometric Association the thanks of the Academy for their help in promoting this meeting and the use of their official office in extending to all COA members our invitation to be with us here in San Francisco at this time. I particularly wish to mention the Executive Director of the California Optometric Association, Mr. Paul Yarwood, who has been most cooperative. We are very appreciative of his fine help.

CONCLUSION

The 1961 meeting of the American Academy of Optometry will be held December 9, 10, 11 and 12 at the Drake Hotel in Chicago. Our Post-Graduate Courses will precede the Annual Meeting of the Academy on December 6, 7 and 8. Members are urged to start planning to attend this meeting.

As Secretary, I am pleased to report that I have received outstand-

*At San Francisco the Committee on Admittance of the Academy completed its work for 1960 and presented its report on Monday, December 12. A large number of applicants were then made Fellows of the Academy. Their names will appear elsewhere in this publication.

ing cooperation from the officers and members of the Executive Council. Also from our Committees, Sections, Chapters and from the membership at large. It has been a genuine pleasure to work with President Fitch whose leadership abilities are evident at all times. As president, Dr. Lawrence Fitch has brought to the Academy a fine loyal spirit of team play and coordination, and we are most indebted to him for his leadership during the past two years.

CAREL C. KOCH

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## TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

## ANNUAL REPORT OF PRESIDENT*

Lawrence Fitch†
Pennsylvania State College of Optometry
Philadelphia, Pennsylvania

It is my great pleasure and privilege to extend greetings to you, Fellows and guests of the Academy, and to welcome you to our annual meeting in this wonderful city of San Francisco. I feel very welcome here myself since I have been in constant touch with the Academy Fellows in this vicinity, particularly with Drs. Meredith W. Morgan, Henry B. Peters and Merton C. Flom, in connection with the arrangements for this meeting. I am sure that all of you will join me in appreciation of the efforts and accomplishments of our California colleagues in making this meeting not only a successful educational event but also a pleasant and enjoyable personal experience.

During the past three days, many of you have participated both as teachers and as students in the annual program of post-graduate courses sponsored by the American Academy of Optometry. You will be interested to know that there were 225 optometrists enrolled in the 75 courses offered and that these courses provided over 3,500 hours of instruction. The success of this post-graduate instructional program

*Read before the annual meeting of the American Academy of Optometry, San Francisco, December 10, 1960. For publication in the January, 1961 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. President and Dean of College. Fellow, American Academy of Optometry.

is largely due to the efforts of Dr. Vincent Ellerbrock, Dr. Dan Hummel and the members of their respective committees.

Our papers program will get underway immediately after this short business session. Dr. Donald Springer and the members of his committee have arranged a superlative program of interesting papers dealing with clinical practice and laboratory research. Dr. John Zettel and the members of his committee have arranged a fine program for the specialty sections which will meet for the next three mornings from 9:00 A. M. to 11:00 A. M. Many of you through previous attendance know what a rewarding experience it is to participate fully in these sessions. I urge those of you who are attending an American Academy of Optometry meeting for the first time to take full advantage of the opportunity to benefit from this outstanding educational and scientific program.

Early this year, the first Academy Home Study Course, *A synopsis of Glaucoma for Optometrists*, authored by Dr. Arthur Shlaifer, became available. Its reception by our profession shows that optometrists have a keen desire for self-improvement in the interest of better service to their fellow man. The first printing of this manual was quickly exhausted and the second printing was made available in July. The demand for copies of this Home Study Course continues to be strong. Dr. Meredith W. Morgan, Chairman of the Home Study Course Committee, hopes that the second Home Study Course will be available during 1961.

On Monday evening, we shall have our usual Annual Round Table Dinner. At this dinner, we shall present Honorary Life Membership in the American Academy of Optometry to Dr. Frank Weymouth in recognition of his lifetime of devotion to the advancement of the science of vision. Also, at the dinner, we shall be privileged to hear an address by the President of the American Optometric Association, Dr. Richard C. Schiller. Dr. Schiller will speak on "Optometry's Search for Itself."

During the year, your officers have received criticism of the Academy's policy of requiring that United States optometrists who are applicants for Fellowship in the Academy be members of the American Optometric Association at the time of admission to the Academy. This policy has been in effect for many years and your officers and members of the Executive Council consider it to be just as sound a policy today as it was at the time of its inauguration. Although the American Academy of Optometry is organizationally entirely independent of the American Optometric Association, with its own distinct objectives, the Academy is complimentary and supplementary to the American

Optometric Association. All optometrists of the United States, including those who are Academy Fellows, have a moral obligation to belong to the American Optometric Association. It is not practical for the Academy to police its Fellows to see if they maintain membership in the American Optometric Association. However, we know that with very few exceptions, Academy Fellows who are in practice here do retain their membership in the American Optometric Association. This is as it should be. The optometrist who aspires to Fellowship in the Academy should realize that if he is not satisfied with some aspect of the American Optometric Association, or one of its affiliated state associations, it is his moral responsibility to work for improvement through his membership. He can accomplish nothing through non-membership.

The record of Academy Fellows in their support of the American Optometric Association and participation in its activities speaks for itself. Certainly, Academy Fellows are by far more staunch members of the American Optometric Association than are the optometrists of any cross-section of our practitioners. This fact is very important to our profession in these troubled times of inadequate enrollments in our optometric colleges and unsatisfactory interprofessional relations. Our major mechanism of defense against the unfair and unwarranted attack of misguided politicians of a sister profession is a strong, healthy parent professional organization.

It has been an honor and a pleasure to serve as your President for these past two years. Our Academy has progressed during that time. I make no claim for this progress. The inherent good in the reasons for the Academy's existence provides the stimulus to you men who devote yourselves to service to the Academy. Certainly, any little contribution which I may have made to our progress is outweighed many times by the benefit derived from my association with Academy Fellows. Among these Fellows, there is one to whom we should accord special mention. He is our Secretary, Dr. Carel C. Koch, whose devoted service to the Academy, year after year, is the core of all our progress.

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# THE CHALLENGE OF ACADEMY MEMBERSHIP*

Ralph E. Wick†
Rapid City, South Dakota

Please accept my thanks for your confidence in electing me to the Presidency of the American Academy of Optometry. To me it is one of the greatest honors which can be obtained in a professional lifetime. I will do my best to be worthy of it.

In the few minutes I have with you tonight, I would like to discuss the Challenge of Academy Membership. Here is an international organization of research men, teachers, and practicing optometrists joined together to promote the highest standards of professional conduct in the practice of optometry and to stimulate research and education by providing a common meeting ground of Fellows with similar interests.

The ideals inherent in the Academy standards of practice have in the past set the pattern and established the goals for optometric conduct. It has been a genuine source of pleasure to me to see that the majority of practicing optometrists in most areas are now eligible for Academy membership on the basis of the standards of practice alone. Why then do the majority of optometrists not apply for fellowship in the Academy? There are, of course, many reasons too diverse to discuss in detail here. I would, however, like to submit the thesis that the most obvious reason is the challenge presented by the membership requirements which include case report preparation and practical examination.

On the other hand, part of the Challenge of Academy Membership is the fact that not everyone can become or even continue on as a Fellow by simply paying his dues. The Fellowship requirements then become both an advantage and a disadvantage to membership growth —an advantage because their very nature sets aside a group of men which is respected by the profession—a disadvantage because many otherwise eligible men are unwilling to submit themselves to this challenge.

In addition to the challenge presented by the existence of a group such as the Academy in the profession there is another and far greater challenge inherent in the attendance at the annual meetings. I would like to illustrate this point by citing a personal experience. After all, membership in the Academy is primarily just that—an extremely interesting and challenging personal experience. I remember vividly my

*Read before the annual meeting of the American Academy of Optometry, San Francisco, December 12, 1961. For publication in the January, 1961 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. President Elect. Fellow, American Academy of Optometry.

first few years of Academy attendance. I never missed a single paper on the regular program and felt quite frustrated because the various sections ran concurrently and I couldn't attend all of them. At first, some of the papers were far beyond me. Gradually with the aid of new textbooks on statistics and by the slow process of intellectual osmosis more and more of the papers became intelligible. I remember equally well my first year on the Executive Council. We had an unusually busy session and I was able to attend the presentation of only a few of the papers presented. I did, however, end up with two pages of the punch lines of some extremely good stories. Now I realize I'm over simplifying this, but the emphasis did shift to a discrimination of the papers which were presented and a closer personal contact with the friends which I acquired from all over the United States. The friends I have made in the Academy have in my opinion provided the greatest challenge of active Academy membership.

Let us make no mistake, however, on the value of the annual program. It is the main reason for our existence or our principal excuse for getting together if you will. The standard of excellence of our program sets the pattern of the Academy itself. The clinical side of optometry is stressed and it is an opportunity for our research men to check out their methods and their results as they put them down in writing. It is a challenge that helps provide a source of material for our literature. For many of us it provides a glimpse into the future, but more important it exposes us to a way of thinking. This can be quite disturbing but there are very few of us who are hurt much by it. Some of the papers in the past have challenged our very professional methods. This is good. Contrary to popular opinion it is challenge that makes the world go around: love only keeps it populated.

The problem now facing us is, how can we use these challenges of Academy membership for the betterment of optometry? The obvious answer is that first of all we must have a strong vital Academy. These are fine words, but what constitutes a strong, vital organization? First of all there has to be sufficient members to constitute a force in optometric thinking. Our President two years ago set a goal of 1,000 members. This was a considerable increase in our membership, but it was realistic. By the end of this meeting we will have reached this goal.

It is now my turn to examine with you some goals for the Academy. Should we now set a goal of 1,200 members? This is a realistic figure at our present rate of growth. With a bit of a membership drive we could probably accomplish this. The Academy, though, as you know does not engage in membership drives. The growth we have

made in the last few years has been a solid one. The new members are of the highest calibre in our profession. I would like to suggest that we continue to select our future applicants every bit as carefully as we have in the past. Furthermore, I would like to suggest that the Council consider membership requirements which if anything are even more restrictive than the present ones are. This will continue to keep out certain qualified men because they are reluctant to face the challenge. This is in many ways regrettable. I feel, however, that it is this very challenge which has built the Academy into the type of organization it is today.

I do not suggest then setting any definite increase numerically as a goal. The Academy in my opinion is now approaching numerically the point at which it constitutes a strong force in optometric thinking, particularly if we continue the calibre of our present membership.

One of the most highly respected organizations in the legal profession has limited the size of its membership to a certain percentage of practicing attorneys. This has been established on a state basis and has operated quite successfully. Its requirements are quite strict including among other things a rigid review of supreme court briefs. The percentage limit on membership in this organization has actually worked to increase the number of applications.

As you might have gathered from my remarks to this point, I see little merit in size alone in an organization such as the Academy. In fact, the *esprit de corps* of the Academy can easily become lost if the group becomes too large. Meeting facilities become more difficult to obtain. The personal relationship among members becomes more difficult to maintain.

The exact number of men to set as our final goal for Academy membership would be difficult to establish. There is no particular merit in setting an exact number. We can by proper organizational procedure absorb additional members without losing our value of small group behavior. Even in some large organizations this has been done by dividing the membership into sections which meet concurrently during the entire meeting. I do not want to see this happen to the Academy. Too much division of the membership at the meetings is contrary to the spirit of our group, as we now know it.

In closing I would like to discuss with you one more challenge of Academy membership. This is the challenge to the very existence of optometry as a profession and, therefore, of deep concern to the Academy. Perhaps one of the most pressing problems of our highly technical and specialized age is that of communication. We are all

familiar with the difficulty of trying to explain a complex visual problem to a patient. The cultural lag from one speciality to another even within a profession is serious enough to present many problems in the health field. In view of this it is almost inconceivable that a segment of a major health profession would go on record against communication with other professions. This action was taken in spite of the fact that in every field of science special effort has been made to improve communication within the specialties and between them. What makes this action especially deplorable is that it was taken in a field of applied science. The main person to suffer in all this is not the optometrist or the eye surgeon, but the patient. For this reason the Academy has a definite responsibility in this area. As individuals and as an Academy we must take a more active interest in national health organizations, in public health, and in scientific organizations. We have for too long talked to ourselves. It is granted that this is more comfortable because we know each other and speak the same language. In far too many instances optometry has been by-passed simply because our contributions, educational requirements, and abilities are not known. In cases where such actions are deliberate we must stand up and be counted. We can not do it if we are not there.

The challenges then of Academy membership are many. They commence with the first decision to try for membership. They continue with active participation in the affairs of the Academy. They are sharpened by contacts with Fellows at annual meetings. We need more members, but of the kind willing to meet our present challenges or even greater ones. The educators, research men, and practicing optometrists which constitute our Fellowship have the responsibility as individuals and as a group to meet the challenges facing optometry.

Optometry as a profession has never had an easy life. We are accustomed to challenges. Let us use these challenges to build a more vital Academy and a still better profession for the betterment of human vision.

810 Mount View
Rapid City, South Dakota

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## SAN FRANCISCO ACADEMY MEETING A SUCCESS

Dr. Ralph E. Wick, Rapid City, South Dakota, was elected president of the American Academy of Optometry on December 12, 1960. The election took place at the Annual Meeting of the Academy, Sheraton-Palace Hotel, San Francisco. Dr. Wick succeeds Dr. Lawrence Fitch, Philadelphia, who has successfully led the Academy for the past two years. Dr. Wick is well known to optometrists as a big game hunter, author and for his interest in geriatrics. He is married and has two sons. He is in private practice in Rapid City where he also serves as president of the School Board.

Dr. Wick attended Dakota Wesleyan University, the University of Chicago and Illinois College of Optometry. He is a Fellow of AAAS and has memberships in the American Public Health Association; Gerontological Society; American Optometric Association and is a member of the President's 1961 Advisory Committee for the Whitehouse Conference on Aging. He has been a member of the Academy since 1945. [See Frontispiece]

Other officers elected were: Dr. Donald A. Springer, Anniston, Alabama, vice president, and Dr. Carel C. Koch, Minneapolis, secretary-treasurer. Dr. Lawrence Fitch will continue to serve as past president on the Executive Council which will consist of the officers and following elected members: Dr. J. Donald Kratz, Souderton, Pennsylvania; Dr. Monroe J. Hirsch, Ojai, California; Dr. Edward J. Fisher, dean, Ontario College of Optometry, Toronto, Canada and Dr. John Zettel, Jr., Cincinnati, Ohio.

The meeting started on December 7 and concluded on December 13. The first three days were devoted to the regular Post-Graduate Courses* of the Academy. The annual meeting opened on December 10 and the four day session was given over to the presentation of original papers by members;** the meetings of the five Academy Sections and the special sessions of the Executive Council. The attendance at all events was excellent and it is believed that more individual optometrists took part in the numerous convention events than at any prior meeting of the Academy.

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*Post-Graduate Courses of American Academy of Optometry. Am. J. Optom. & Arch. Am. Acad. Optom. 37.8.421-434. 1960.

**General Program for San Francisco Academy Meeting. Am. J. Optom. & Arch. Am. Acad. Optom. 37.11.595-562. 1960.

The programs followed by the Sections were as follows:

## SECTION ON PUBLIC HEALTH AND OCCUPATIONAL OPTOMETRY

Henry B. Peters, O.D., M.A., Chairman, Oakland, California.

Sunday, December 11, 1960. 9:00 A.M. - 11:00 A.M.

Dr. Lois Bing, Presiding

GENERAL TOPIC: VISION SCREENING OF SCHOOL CHILDREN

(1) Hypermetropia and Scholastic Achievement Relationship Found in Elementary School Children. S. H. Burgess, O.D.

(2) The Modified Clinical Technique Applied to Fourteen Thousand First Grade Pupils. Bernice Flom, O.D., Medical Consultant for Vision Screening, Contra Costa County School Department.

(3) Vision Screening and Visual Health Education. Joseph Farrington, O.D., Consultant, California State Department of Public Health, Sacramento County School Department.

Monday, December 12, 1960. 9:00 A.M. - 11:00 A.M.

Dr. Galen Kintner, Presiding

GENERAL TOPIC: PUBLIC HEALTH OPTOMETRY

(1) Vision Program of the California State Health Department and the Role of the Optometrist. William D. Simmons, Supervisor, Prevention of Blindness Program, State Department of Public Health.

(2) The Optometrist in Civil Defense. Arthur B. Emmes, O.D., Consultant to the Governor's Medical Advisory Committee of the California Disaster Office.

Tuesday, December 13, 1960. 9:00 A.M. - 11:00 A.M.

Dr. Henry B. Peters, Presiding

GENERAL TOPIC: PLANNING FOR THE FUTURE

This session was devoted to a symposium by the sub-committee chairmen defining the scope of activities, present status and future needs of each sub-committee.

(1) Industrial and Occupational Vision and Vision Screening. Herman Sager, O.D., Lake Success, New York.

(2) Vision Problems of School Children and Vision Screening. Lois Bing, O.D., Shaker Heights, Ohio.

(3) Vision Problems in Transport Operations and Vision Screening. Richard Feinberg, Ph.D., Petersburg, Virginia.

(4) Optometry in Group Practice, Clinics and Hospitals. Darrell Carter, Ph.D., Houston, Texas.

(5) Prepaid Vision Care Programs. Felix Koetting, O.D., St. Louis, Missouri.

(6) Optometry's Relations with Public Health Programs. Galen Kintner, O.D., Lynden, Washington.

(7) Optometry's Participation in Civil Defense. Arthur Emmes, O.D., Castro Valley, California.

(8) Visual Environment. Sylvester Guth, Ph.D., Cleveland, Ohio.

## SECTION ON PATHOLOGY

Arthur Shlaifer, O.D., Ph.D., Chairman, Philadelphia, Pennsylvania.

Sunday, December 11, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Vision in the Aging. General introductory remarks. Ralph E. Wick, O.D., Rapid City, South Dakota.

9:20 A.M. Anatomical and Physiological Changes Associated with Aging. Bernard Mazow, O.D., Houston, Texas.

10:15 A.M. Ocular Pathology in the Aging. Arthur Shlaifer, O.D., Philadelphia, Pennsylvania.

Monday, December 12, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Corneal Pathology with Special Emphasis on Contact Lens Fitting. Harold Simmerman, O.D., Wenonah, New Jersey.

10:30 A.M. Photography of External Ocular Pathology by the Optometrist. Monroe Hirsch, O.D., Ph.D., Ojai, California.

Tuesday, December 13, 1960. 9:00 A.M. - 11:00 A.M.

Interprofessional consideration in the Use of the New, Accurate, Fast, Gentle, Recording Tonometer by Optometrists. Elwin Marg, O.D., Ph.D., Berkeley, California.

Panel discussion of above with Dr. Monroe J. Hirsch, Dr. Arthur Shlaifer, Dr. Harold Simmerman.

## SECTION ON REFRACTIVE PROBLEMS AND ANISEIKONIA

William P. Schumann, O.D., Chairman, Vineland, New Jersey

Sunday, December 11, 1960. 9:00 A.M. - 11:00 A.M.

A New Technique of Aniseikonia Investigation and Research. Thaddeus R. Murroughs, B.S.M., S.O.D., Santa Barbara, California.

Monday, December 12, 1960. 9:00 A.M. - 11:00 A.M.

Lens Design and Design Instructions. Thaddeus R. Murroughs.

Tuesday, December 13, 1960. 9:00 A.M. - 11:00 A.M.

New Instrumentations and Refractive Techniques. Merrill J. Allen, O.D., Ph.D., Professor of Optometry, Indiana University, Bloomington, Indiana.

Changes in Aniseikonia with Refractive Changes in Presbyopia, etc. Arlene T. Wray, O.D., Los Angeles, California.

Recent Developments in the Field of Aniseikonia and Refraction. Robert E. Bannon, O.D., Buffalo, New York; Harold M. Fisher, O.D., New York; Oscar L. McCulloch, Holyoke, Massachusetts.

## SECTION ON CONTACT LENSES AND SUBNORMAL VISION

Robert C. Graham, O.D., Chairman, Pasadena, California.

Sunday, December 11, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Advantages of Microscopic Corneal Lens Perforations. Donald R. Korb, O.D., Boston, Mass.

9:45 A.M. Continuing Developments in Bifocal Contact Lenses. George Jessen, O.D., Chicago, Illinois.

10:30 A.M. Advances in Contact Lens Fitting. William Feinbloom, Ph.D., New York City.

Monday, December 12, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Reasons for Unsuccessful Contact Lens Fitting. Allan A. Isen, O.D., Buffalo, New York.

9:45 A.M. The Situation in Contact Lenses. Harold I. Moss, O.D., Wilmington, Delaware.

10:30 A.M. The Application of Lenses 8 mm in Diameter and 1/10 mm in Thickness. George Jessen, O.D., Chicago.

Tuesday, December 13, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Relief of Photophobia Associated with Contact Lenses. Solon M. Braff, O.D., El Monte, California.

10:00 A.M. Ocular Physiology and Contact Lenses. Darrell B. Carter, Ph.D., Houston, Texas.

## SECTION ON ORTHOPTICS

Max Schapero, O.D., Chairman, Los Angeles, California

Sunday, December 11, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Analysis and Considerations of Present Pleoptic Techniques and Instrumentation. Hernando Henao, Jr., O.D., Bogota, Columbia, South America.

9:45 A.M. Asthenopia and Orthoptics. William Smith, O.D., Canoga Park, California.

10:15 A.M. The Effect of Visual Training Upon the Visual Efficiency Score. Leo Manas, O.D., Chicago, Illinois.

Monday, December 12, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. A Report of Eight Strabismic Patients Fitted with Contact Lenses. Robert Mandell, O.D., Bloomington, Indiana.

10:00 A.M. Duration of Fixation as Related to Saccadic Movements and Phorias. Howard N. Walton, O.D., Culver City, California.

Tuesday, December 13, 1960. 9:00 A.M. - 11:00 A.M.

9:00 A.M. Refractive, Sensory, and Motor Problems Produced by Contact Lenses. Phillip R. Haynes, O.D., Newark, Ohio.

10:00 A.M. A Comparison of O.E.P. and Graphic Analysis in Orthoptics. J. Donald Kratz, O.D., Souderton, Pennsylvania.

At the Annual Round Table Dinner of the Academy on December 12th an Honorary Life Fellowship in the Academy was awarded to Dr. Frank W. Weymouth, 76, who has long been a member of the Academy. Dr. Weymouth received his Ph.D. at Stanford University in 1923. He is a member of Phi Beta Kappa and Sigma Xi. He served as professor of physiology and later head of this department at the Stanford School of Medicine. While here he supervised a number of important research programs in vision and during World War II he headed several governmental projects also dealing with visual research. He has a long and impressive list of publications, some in this journal. In 1949 Dr. Weymouth retired from Stanford and in 1950 he moved to the Los Angeles College of Optometry where he served

as professor until 1960. Here he taught statistics and physiological optics. At present he is a research associate at the University of California, Berkeley, working on one of the major research projects in the School of Optometry. This award to Dr. Weymouth was presented on behalf of the Academy by Dr. Meredith W. Morgan, dean of the School of Optometry at the University of California. It is expected that Dr. Weymouth's response will be published in a later issue.

Other speakers at the Annual Round Table Dinner were Dr. Richard C. Schiller, Marshalltown, Iowa, president of the American Optometric Association: Dr. Lawrence Fitch and Dr. Ralph E. Wick. Their talks will be published. During the dinner program, Dr. Harold Simmerman, chairman of the Committee on Admittance, introduced the new Fellows.

The Executive Council of the Academy, under the direction of President Fitch, was in session throughout much of the meeting. The first three days were devoted to a study and review of the usual housekeeping and membership activities of the Academy. After these important routine matters were concluded, action was taken on the following:

- A new payment schedule devised for authors preparing material for publication under the auspices of the Academy Home Study Course Committee.
- Reviewed the activity of the Vision Information Program, Indianapolis. The Executive Council found this program to have considerable merit and commended it to the membership.
- Reviewed the proposal of the Committee on Admittance for certain alterations in the manner of presenting the clinical examination to applicants for Academy Fellowship. It was decided that the committee should put these new proposals into effect for 1961 and again report on these next December.
- Received and studied a preliminary report from the Post-Graduate Course Committee relating to the courses just concluded. Approximately 3,500 hours of instruction were given to optometrists from 24 states and three Provinces of Canada. Approximately 225 optometrists enrolled in this Post-Graduate program.
- Considered and approved a report from the Section on Orthoptics to change the name of the Section to the *Section on Binocular Vision and Perception.*
- Approved the following statement relative to contact lens fitting and authorized its release to the public.

"The American Academy of Optometry is proud of the pioneering work of many of its Fellows in the research and development of modern contact lenses which has brought great benefit to the public.

"It is the considered opinion of the Executive Council of this Academy that contact lenses are safe under the following conditions:

1. When they are fitted directly and personally by an optometrist, and
2. If subsequent care is personally supervised by an optometrist, and
3. If the patient cooperates and follows wearing instructions given him by his optometrist.

"On the other hand, the Academy is aware of the dangers inherent on the exploitation of this field of eye care by unscrupulous persons. Unfortunately, unlicensed and inadequately trained persons do engage in the fitting of contact lenses and often are indifferent to the visual welfare of the patient. The public can avoid this danger by consulting only licensed eye care practitioners who fit these lenses personally.

"Fellows of the American Academy of Optometry have a moral obligation to protect the visual welfare of the public not only in their private practices but also in their professional organizations and public activities."

During the meeting Dr. Monroe J. Hirsch and Dr. Ralph E. Wick, editors of *Vision for the Aging Patient*, were presented Silver Awards by the Distinguished Service Foundation for the excellence of their work. The awards were presented at the Round Table Dinner by Dr. James F. Wahl, Forest Grove, Oregon, dean, College of Optometry, Pacific University.

During the meeting an Academy *Eminent Service Award* was presented to Paul Yarwood, Sacramento, California, administrative director of the California Optometric Association for his many years of outstanding service in behalf of the profession and for his help in making the San Francisco meeting of the Academy such a success.

The 1961 annual meeting of the Academy will be held at the Drake Hotel, Chicago.

CAREL C. KOCH

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## NEWLY ELECTED FELLOWS OF THE ACADEMY

Dr. Floyd P. Archer, Homestead, Florida; Dr. Paul A. Asleson, Redwood Falls, Minnesota; Major Robert W. Bailey, Fort Knox, Kentucky; Dr. Frank S. Beard, Albertville, Alabama; Dr. Jean Bergevin, Verdun, P. Q., Canada; Dr. Ira J. Bernstein, Mount Vernon, New York; Dr. Thomas C. Bingham, Decatur, Alabama; Dr. George G. Brassard, Ventura, California; Dr. Henry L. Bumgardner, Iola, Kansas; Dr. William J. Burrows, Crestview, Florida; Dr. George J. Buto, Honolulu, Hawaii; Dr. W. Judd Chapman, Tallahassee, Florida; Mrs. Harriette M. Cluxton, Chicago; Dr. George M. Cohen, Gloucester, Massachusetts; Dr. Stanley K. Dickens, Fontana, California; Dr. James F. Dickson, Jr., Lindsay, California; Dr. Pauline Dowaliby, Beverley Hills, California.

Dr. H. Mitchell Emerick, Philadelphia; Dr. Stanley P. Evans, Woodside, Long Island, New York; Dr. Bernard Feldman, Westfield, New Jersey; Dr. Herbert Fischer, Pittsfield, Massachusetts; Dr. Wayne E. Frantz, Iola, Kansas; Dr. Allen N. Fried, Saratoga, California; Dr. Michael A. Friedberg, Carnegie, Pennsylvania; Dr. Max H. Friedman, Portland, Oregon; Dr. Orleane K. Haugen, Riviera Beach, Florida; Dr. David D. Haughton, West Palm Beach, Florida; Dr. Richard L. Haney, Denver; Dr. Richard M. Hill, Berkeley; Dr. David T. Huang, Chicago; Dr. Elwood H. Kolb, Allentown, Pennsylvania; Dr. Donald R. Korb, Boston; Dr. Richard A. Kramb, Arcadia, California.

Dr. Robert W. Lester, San Francisco; Dr. Alvin Levin, Carlisle, Pennsylvania; Dr. Yim Fee Look, Honolulu, Hawaii; Dr. Louis L. McCormick, Hutchinson, Kansas; Dr. Seymour C. Marcuse, Vallejo, California; Dr. William A. Meyer, Jr., Sacramento; Dr. Leland D. Michael, Rapid City, South Dakota; Dr. Foster Namias, Boston; Dr. William L. Nelson, Chula Vista, California; Dr. Benjamin Nerenberg, Los Gatos, California; Dr. Harold Neuwirth, New York City; Dr. Leonard Osias, San Lorenzo, California; Dr. Charles B. Parker, Jerome, Idaho; Dr. C. Oliver Patterson, Grass Valley, California; Dr. J. O. Pence, Arroyo Grande, California; Dr. Joseph A. Perka, Pittsburgh; Dr. Henry N. Peters, Memphis; Dr. L. Eugene Peterson, Rexburg, Idaho; Dr. Fred M. Reid, Santa Fe, New Mexico; Dr. Norman H. Rice, Cocoa, Florida; Dr. Bernard E. Rothman, Silver Spring, Maryland; Dr. Robert Rosenberg, Great Neck, Long Island, New York.

Dr. Arthur R. Sanderson, Chatham, Ontario, Canada; Dr. Samuel Schein, Uniontown, Pennsylvania; Dr. Irvin G. Selbert, Amsterdam, New York; Dr. Abraham J. Shack, Newark, New Jersey; Dr. Charles R. Shick, Bloomington, Indiana; Dr. Irvin W. Silberstein, Daly City, California; Dr. Philip G. Sloan, Palo Alto, California; Dr. Joseph H. Smith, Plymouth, Pennsylvania; Dr. George D. Spache, Gainesville, Florida; Dr. Robert E. Spafford, Concordia, Kansas; Dr. Ellen S. Takahashi, San Francisco; Dr. Maurice M. Tartell, Johnstown, New York; Dr. Akira Tajiri, Reedley, California; Dr. B. Tedeson, Vero Beach, Florida; Dr. B. L. Tims, Scottsdale, Arizona; Dr. Duncan K. Turnbull, Ladysmith, Natal, South Africa; Dr. James R. Vanderlaan, Amarillo, Texas; Dr. D. Leonard Werner, Yorktown Heights, New York; Dr. Raymond H. Williams, Redondo Beach, California; Dr. Bill John Wilson, Lemoore, California; Dr. Marie Wolff, Scottsburg, Indiana.

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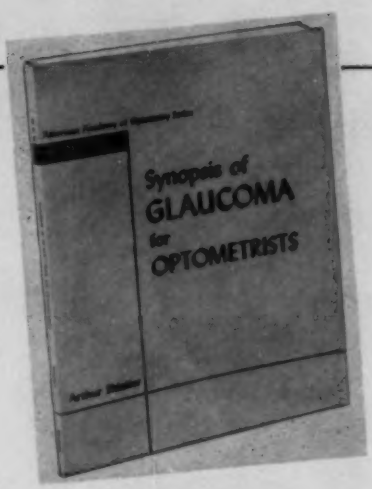


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*Journal of the American Optometric Association*

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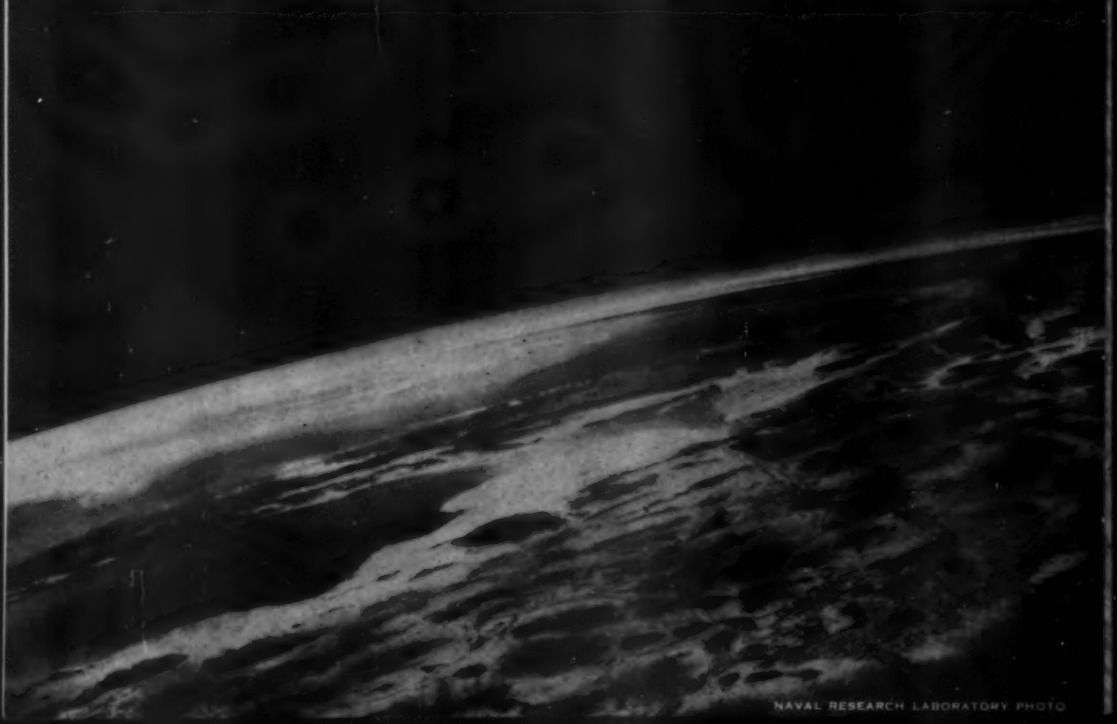

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